GHS Series Volume IX

Environment, in-depth analysis of the General Household Survey 2002–2016

Report 03-18-08

THE SOUTH AFRICA I KNOW, THE HOME I UNDERSTAND

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Environment

In-depth analysis of the General Household Survey 2002–2016

Statistics South Africa

Report No. 03-18-08 (2002–2016)

Risenga Maluleke
Statistician-General

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Glossary of abbreviations

WC	Western Cape
EC	Eastern Cape
NC	Northern Cape
FS	Free State
KZN	KwaZulu-Natal
NW	North West
GP	Gauteng
MP	Mpumalanga
LP	Limpopo
RSA	Republic of South Africa
CS	Community Survey
CSIR	Council for Scientific and Industrial Research
DEA	Department of Environmental Affairs
DEAT	Department of Environmental Affairs and Tourism
GHS	General Household Survey
LSM	Living Standard Measures
MDG	Millennium Development Goals
NDP	National Development Plan
NEMA	National Environmental Management Act
NEMWA	National Environmental Management Waste Act
NPC	National Planning Commission
NWMS	National Waste Management Strategy
SDG	Sustainable Development Goals
Stats SA	Statistics South Africa
UN	United Nations

Glossary of concepts

Buy-Back Centre Facility where individuals or groups can take recyclables in return for payment

Collection Act of collecting domestic waste at the place of waste generation or storage by an approved service provider or the municipality (DEA 2011)

Domestic waste Waste that emanates from premises that are wholly or mainly for residential, education, health care, sport or recreational purposes. Domestic waste can be classified into recyclable and reusable, compostable and non-recyclable or non-usable waste.

General solid waste Waste that does not pose an immediate hazard or threat to health or to the environment, and include domestic waste, building and demolition waste, business waste and inert waste. In addition, domestic waste excludes hazardous waste, and emanates from premises that are used wholly or mainly for residential, educational, health care, sport or recreation purposes. (Waste Act, 2008)

Income quintiles A quintile is one-fifth or 20% of a given number. The poorest per capita quintile (quintile 1) represents households that fall into the lowest fifth of the data on monthly household income. Quintile 2 represents households that fall into the second fifth and so on. The wealthiest quintile, quintile 5, contains households that fall into the top one-fifth of data (81% - 100%). The monetary cut off values for income quintiles are as follows:

- Quintile 1: R0 – R434
- Quintile 2: R435 – R895
- Quintile 3: R896 – R1834
- Quintile 4: R1835 – R4741
- Quintile 5: larger than R4741

Informal sector That part of an economy that is not recognised or monitored by government, often not taxed, or captured in national statistics.

Living Standard Measure (LSM) LSMs group people and households into ten distinct groups based on criteria such as their level of urbanisation, ownership of vehicles and major electrical appliances. The measurement is classified from LSM 1 to 10. For the purposes of this report, these categories are combined as follows:

- Low: LSM 1 – 4
- Intermediate: LSM 5-7
- High: LSM 8-10

Metropolitan municipality Metropolitan municipality means a municipality that has exclusive executive and legislative authority in its area, and which is described in section 155(1) of the Constitution as a category A municipality. (Refer to Local Government: Municipal Structure Act 1998, (Act No, 117 of 1998).

Receptacle Container designed solely for the purpose of temporary storage of household waste at the household, either provided by the municipality or by the household, until such time of collection by the service provider/municipality.

Recycling	Recycling is the process whereby discarded products and materials are reclaimed or recovered, refined or reprocessed, and converted into new or different products. This term is often used in a wider sense to describe the complete cycle, from collection to production of new objects, or secondary raw materials, from reclaimed material.
Refuse removal	The collection, treatment and disposal of waste
Rural area	Any area that is not classified urban. Rural areas may comprise one or more of the following: tribal areas, commercial farms and informal settlements.
Service provider	Provider of domestic waste collection services, be it the municipality, external entity or community that is contracted by the municipality to render a municipal service.
Solid waste management services	Provision of refuse removal service to consumer units at least once-a-week, less often than once per week.
Urban area	A continuously built-up area with characteristics such as type of economic activity and land use. Cities, towns, townships, suburbs, etc. are typical urban areas.
Waste	Any substance, whether or not that substance can be reduced, re-used, recycled and recovered: • That is surplus, unwanted, rejected, discarded, abandoned or disposed of • Which the generator has no further use of for the purposes of production • That must be treated or disposed of • That is identified as waste by the Minister by notice in the Gazette, and includes waste generated by mining, medical or other sector, but (i) a by-product is not considered waste; and (ii) any portion of waste, once re-used, recycled and recovered, ceases to be waste (Waste Act, 2008)

Foreword

The South African Constitution (RSA, 1996) makes it clear that all South Africans are entitled to an environment that is “not harmful to their health and well-being”. The creation and maintenance of such an environment is a complex and multi-faceted endeavour involving a number of role players. Sound solid waste management is one of the main mechanisms that local Government can use to begin to address this challenge.

This report uses existing data collected through the General Household Survey and Community Survey 2016 to explore solid waste practices, waste disposal, and perceptions about waste and health across a large representative sample of South African households.

The study on solid waste management services has identified huge variations between different geographical areas. While rural areas were largely left to use mostly unregulated communal waste fills, some communities have no place to dump waste at all, urban areas almost exclusively relied on landfills for waste disposal. Despite the implementation of the Waste Act in 2009 (RSA, 2008) relatively few households participate in recycling activities, meaning that most of the waste still end up on landfills, or worse, blowing in the wind. The lack of recycling is exacerbated by the low percentage of households in rural areas that have access to refuse removal services and the study calls for the expansion of such services to underserviced areas using innovative techniques.

Regular waste removal, perceptions about the presence of environmental problems in one’s immediate neighbourhood, as well as recycling activities were clearly split along socio-economic lines, with wealthier households having access to better and more regular refuse removal services, being more likely than poorer households to participate in recycling activities and also less likely to complain of pollution in their neighbourhoods. When poorer households are taking part in recycling activities it is mostly to earn an income whereas wealthier households are more likely to recite environmental concerns as their motivation.

There is a general need to expand the statistical measurement and reporting for this sector both through administrative data sets and household surveys. Not only an expansion of collection, but also the optimization of the use and sharing of existing data sources require attention. Questionnaires and methodologies should be reviewed with a wide variety of stakeholders to ensure that the right questions are asked and that appropriate information can be made available for planning or monitoring.

Risenga Maluleke
Statistician-General

1 Introduction

1.1 Background

Human activity continues to damage the environment through the unsustainable exploitation of resources and the uncontrolled generation of waste and pollution. Environmental concerns have become important political and social issues as the effects of centuries of environmental exploitation and pollution become clearer by the day, threatening economic prosperity and social cohesion.

Atmospheric degradation, environmental destruction and health problems can be linked directly to poor waste management practices. South Africa is faced with a rapid increase in the volume of solid waste that is produced annually. Population growth, urbanisation and economic development have resulted in changing patterns of resource consumption and a rapid increase in the type and volume of waste generated by households (Nkosi, 2014). Increased consumption not only requires more resources, but also leads to increased waste which affects environmental quality and ultimately health. The increased volume of waste adds further strain to a system that is already stretched by backlogs in the provision of waste removal and disposal services. Solid waste management services are critical to maintain environmental sustainability by protecting water courses, groundwater, and preventing illegal dumping and littering (National Treasury, 2011). If waste is not collected, stored and disposed of correctly, it could lead to an aesthetic and public health problem which will asymmetrically affect poor households. Poor communities that lack adequate solid waste management services are often afflicted by health issues such as gastrointestinal, respiratory, dermatological and other infectious diseases.

Given the numerous environmental, public health and economic concerns, solid waste management requires the urgent implementation of sustainable, coordinated and efficient strategies in order to give credence to the constitutional provision that South African citizens are entitled to an environment that is “not harmful to their health and well-being” (Constitution of the Republic of South Africa, 1998).

1.2 Objectives of this report

Achieving the constitutional right to a clean and healthy environment is a complex, multifaceted endeavour that involves a wide variety of stakeholders and activities. The objectives of the report are to:

- Describe the state of solid waste management services in South Africa, and identify household predictors of adequate solid waste management services. This section will also investigate if households pay for solid waste services;
- Assess household participation in recycling and attempt to identify the characteristics of participating households with a view to supporting programme development and targeting.
- Explore the relationships between perceptions, behaviours and awareness regarding four environmental conditions in South Africa, namely littering, water pollution, air pollution, and land degradation. This section also attempts to establish whether environmental concerns differ across the country and between sub-groups.

1.3 International context and Sustainable Development Goals (SDGs)

Concern for the natural environment has been steadily increasing since the 1950s as societies became more alarmed about population growth and the exploitation of natural resources. By the 1970s it was generally agreed that the unbridled economic growth could simply not be sustained by the natural environment and that social and economic changes were required to make growth sustainable. A declaration containing 26 principles, including the recognition that the natural environment should have equal importance than social and economic development, was adopted at the United Nations Conference on Human Development, also referred to as the Stockholm Conference in 1972. The environmental focus was further sharpened by the publication, in 1987, of the Brundtland commission's seminal report, Our Common Future. This laid an important foundation for the United Nations Conference on Environment and Development, also known as the Earth Summit, held in Rio de Janeiro in 1992. The Rio Conference, amongst other things, created a blueprint for sustainable development known as Agenda 21, and gave rise to an agreement that would eventually become the Kyoto Protocol on climate change. This second World Summit on Sustainable Development took place in Johannesburg in 2002. The commitments made by participating countries were reaffirmed at the third Earth Summit held in Rio De Janeiro in 2012, also known as Rio+20 (DEA, 2012).

The Millennium Development Goals (MDGs) represented another step towards integrating the environmental, social and economic dimensions of sustainable development. These goals comprised six goals on social welfare, and one dealing with ensuring environmental sustainability. Despite recording significant progress, development was geographically uneven. In addition to persisting poverty and inequality, the United Nations (2015) notes that climate change and environmental degradation not only threatens progress made, but that poor people are the most vulnerable.

Table 1.1: Sustainable Development Goals that are relevant to the environment

Goals	Targets
Goal 9: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation	• By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities.
Goal 11: Make cities and human settlements inclusive, safe, resilient and sustainable	• By 2030, ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums. • By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management • By 2030, provide universal access to safe, inclusive and accessible, green and public spaces, in particular for women and children, older persons and persons with disabilities
Goal 12: Ensure sustainable consumption and production patterns	• By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment • By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse.
Goal 17. Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development	• Promote the development, transfer, dissemination and diffusion of environmentally sound technologies to developing countries on favourable terms, including on concessional and preferential terms, as mutually agreed.

At the conclusion of the Millennium Development Goals in 2015, the United Nations General Assembly adopted the 2030 Agenda for Sustainable Development, which introduced the Sustainable Development Goals (SDGs). This agenda aims to replace unsustainable consumption and production patterns with sustainable lifestyles and livelihoods that benefits all based on the understanding that a healthy, well-functioning environment is non-negotiable for development. Ensuring more sustainable production and consumption patterns (goal 12), and addressing waste management as a priority is vital to achieve the SDGs as waste impacts virtually all spheres of the environment.. Some of the most applicable goals and targets are outlined in Table 1.1.

1.4 National context

1.4.1 South African constitution

The Constitution of South Africa (RSA, 1996) provides the foundation for environmental regulation and policy in South Africa. The Bill of Rights (section 24 of chapter 2) states that everyone has the right to an environment that is not harmful to their health or wellbeing; and to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that (i) prevent pollution and ecological degradation; (ii) promote conservation; and (iii) secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.

1.4.2 National Environmental Management Act

This fundamental right underpins environmental policy and law, in particular the framework environmental legislation established by the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA). This act provides a legal structure that ensures that the main objectives for environmental policies and decision-making in South Africa can be achieved. The Act is crucial in terms of implementing the constitutional provisions on cooperative governance in environmental matters as it creates the institutional set-up for the development of norms and standards for the implementation of the environmental legislation and provides for generic monitoring and enforcement provisions. Among these are the duty of care provisions and obligations to control and remedy pollution generally. In conjunction with the NWA, the NEMA provides an avenue to regulate and control water pollution and promote the fulfilment of the right to an environment not harmful to health or well-being. Importantly, it also creates a specialised enforcement unit of environmental management inspectors charged specifically with the enforcement of environmental management legislation.

The principles of NEMA apply to the National Environmental Management Act: Waste Act, 2008 (Act 59 of 2008), also referred to as NEMWA, which provides the framework legislation for the promotion of sustainable waste management practices in the country.

An overview of some appropriate environmental legislation and regulations is provided in Table 1.2.

Table 1.2: South African environmental legislation and strategies

Year	Legislation	Main emphasis
1996	Constitution, Act 108 of 1996	Waste removal local government function
1989	Environmental Conservation, Act 73 of 1989	Environmental Impact Assessment Regulation
1998	National Environmental Management Act, 107 of 1998	Framework for the protection of the environment
	Local Government Municipal Structures Act (Act 117 of 1998)	
1999	National Waste Minimization strategy	Waste minimisation and prevention
2000	Whitepaper on integrated pollution and waste management in South Africa	Prevention of pollution, waste minimisation, and considering other alternatives
	Local Municipal Systems Act (Act 32 of 2000)	
2001	National Waste Summit – Polokwane declaration	First national summit on waste
2007	National waste management bill	
2008	National Environmental Management: Waste Act	Overarching national legislation on waste management
2011	National waste management strategy	
2014	National Environmental Management: Waste Amendment Act (Act 26 of 2014)	

Source: Adapted from Engledow (2007)

1.4.3 National Development Plan (NDP)

South Africa has, in the National Development Plan, committed itself to ensure that the natural resource base would not be irretrievably damaged or depleted while improving economic activity and social welfare. The plan accepts that the global economy has entered a period of 'ecological deficit' as natural capital (groundwater, marine life, terrestrial biodiversity, crop land and grazing) is being degraded, destroyed, or depleted faster than it can be replenished. Since waste contributes to two percent of emissions, the country is committed to cut down on solid-waste disposal by promoting composting and recycling of organic waste, and by capturing land-fill gas methane. The plan also calls for absolute reductions in the total volume of waste disposed to landfill annually through the implementation of the National Waste Management Strategy (NPC, 2012).

1.4.4 Medium Term Strategic Framework (MTSF)

South Africa has rich natural and environmental resources which have to be protected, and their degradation reversed, if development is to be sustained and environmental diversity is to be preserved. South Africa is water-stressed and faces weather variability with cycles of droughts and sudden excessive rains, and the quality of aquatic ecosystems is declining. South Africa is also a significant contributor to greenhouse gas emissions and is vulnerable to the impacts of climate change on the economy, water, food security, health and natural resources. Our environmental governance regime is sound and is supported by an excellent science base, but there are capacity constraints in compliance monitoring and enforcement. Information management systems are also still inadequate. If the current challenges are not effectively addressed, environmental degradation will put the achievement of our development goals at risk, threatening food security, mining, tourism, water supply and public health. The NDP vision is that South Africa's transition to an environmentally sustainable, climate change resilient, low-carbon economy and just society will be well underway by 2030. The main focus for the MTSF period will be on planning, piloting and

investing in the creation of a framework for implementing the transition to an environmentally sustainable and low-carbon economy in South Africa. This phase will include unblocking regulatory constraints, data collection, establishment of baseline information, and testing key strategies for change, to determine if these can be scaled up.

2 Methodology

2.1 Data sources

A number of Statistics South Africa (Stats SA) surveys were utilised in this report. Data from the annual General Household Survey (GHS) were used for analysis at household, provincial and metro levels. The GHS has been conducted annually since 2002 by Stats SA and was specifically designed to measure the multiple facets of the living conditions of South African households. It covers six broad areas, namely education, health and social development, housing, household access to services and facilities, food security, and agriculture. Data from the GHS contribute, amongst other things, towards the monitoring of selected indicators in relation to the performance of various government departments. Community Survey 2016 data are used for analysis at sub-provincial level. The report also used, on a much more limited scale, data from the Non-financial census of municipalities.

2.2 Methodology

The report contains three sections, namely on solid waste management, recycling, and environmental perceptions. Each section provides a descriptive overview of pertinent patterns over time or between dimensions, and multivariate models, logistic regression, are used to identify factors that predict particular behaviours such as access to solid waste removal services; recycling, or particular environmental perceptions.

2.3 Limitations

All three sections rely on data obtained from the household section which was answered by a proxy respondent who ought to be the household head, but who could also be any representative over the age of 16 years in cases where the head is not available to be interviewed. The household respondent can in most cases, unfortunately, not be identified, making it impossible to identify and use individual characteristics that could greatly assist with the interpretation of individual perceptions regarding the environment, or opinions about whether their households would be willing to pay for waste services if they had the opportunity. As with all questions answered by proxy respondents, a risk exists that they might not have all, or the correct information about more obscure issues such as whether the household pays for municipal services.

Another limitation relate to the data's lowest level of disaggregation. Questions in the General Household Survey (GHS) can only be disaggregated to provincial, or metropolitan level. Since similar and comparable questions are carried by Community Survey, data on solid waste management is also available on district level for 2016.Most unfortunately, neither the census nor the Community Survey asked any questions on recycling. In fact, a relatively comprehensive module on recycling has only been included in the 2014 and 2015 versions of the GHS, meaning no sub-metropolitan level analysis is possible. The recycling questions used during these years were furthermore slightly different and therefore not completely comparable with from those that were used in earlier GHSs. A final limitation is that the recycling question relied on a binary yes or no question, rather than a more nuanced set of options that would have allowed more finely grained analysis of the frequency and volume of recycling.

3 Solid waste management

3.1 Introduction

Waste management is the collection, transport, processing or disposal, managing and monitoring of waste materials. The term usually relates to materials produced by human activity and the process is generally undertaken to reduce their effect on health and the environment. Waste management is a distinct practice from resource recovery which focuses on delaying the rate of consumption of natural resources. Generally, waste management tends to treat all waste materials as a single class, whether solid, liquid, gaseous or radioactive substances, and attempt to reduce the harmful environmental impacts of each through different methods.

According to the Department of Environmental Affairs (2012) waste is typically divided into two classes based on the potential risk it poses. The Waste Act (RSA, 2008) defines general solid waste as waste that does not pose an immediate hazard or threat to health or to the environment, and which includes domestic waste, building and demolition waste, business waste and inert waste. This type of waste usually emanates from premises that are used wholly or mainly for residential, educational, health care, sport or recreation purposes. By contrast, hazardous waste is defined as 'any waste that contains organic or inorganic elements or compounds that may, owing to the inherent physical, chemical or toxicological characteristics of the waste, have a detrimental impact on health and the environment (RSA, 2008). This report will focus on municipal solid waste as this information is easily available from most household surveys.

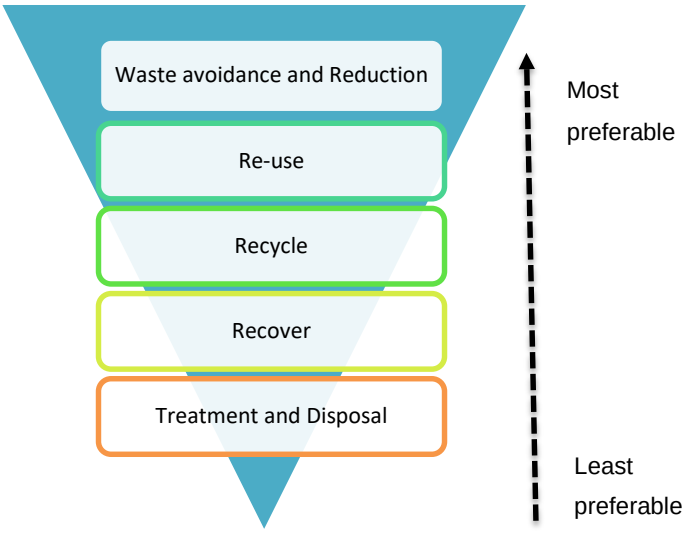
South Africa's commitment to sustainable development is aimed at balancing the broader economic and social challenges of a developing and unequal society, while protecting environmental resources. For the waste sector in South Africa this means careful consideration must be given to raw material use, product design, resource efficiency, waste prevention, and minimization where avoidance is impossible.

A number of issues continue to be challenges for effective waste management (DEA, 2012). These include ineffective data collection systems and lack of compliance and enforcement capacity, lack of education and awareness amongst stakeholders within the waste sector, operational costs for management of waste, support for waste reduction at local government level, availability of suitable land for waste disposal, lack of structured incentives for reduction, and recycling and/or reuse of waste.

3.2 The waste management hierarchy approach

The principles of the National Environmental Management Act (RSA, 1998) extend to the National Environmental Management Act: Waste Act, 2008 (Act 59 of 2008), also referred to as NEMWA, which provides the framework legislation for the promotion of sustainable waste management practices in the country. The Act prioritizes the principles of the waste management hierarchy which outlines options for waste management during the lifecycle of waste in descending order of importance: addressing prevention, minimization (reduce, re-use and recycle), treatment, and safe disposal as last resort (UNEP, 2010; DEA, 2011b). The hierarchy is presented in Figure 3.1.

Figure 3.1: Waste Management Hierarchy



Source: Adapted from DEA (2011, 2012)

As its foundation, the hierarchy emphasises the **avoidance or reduction** of waste by minimizing the waste components of products through design, and by limiting the quantity and toxicity of waste generated during production.

Re-using waste forms the next step of the hierarchy. Recycled articles are removed from the waste stream for use in a similar or different purpose without changing its form or properties.

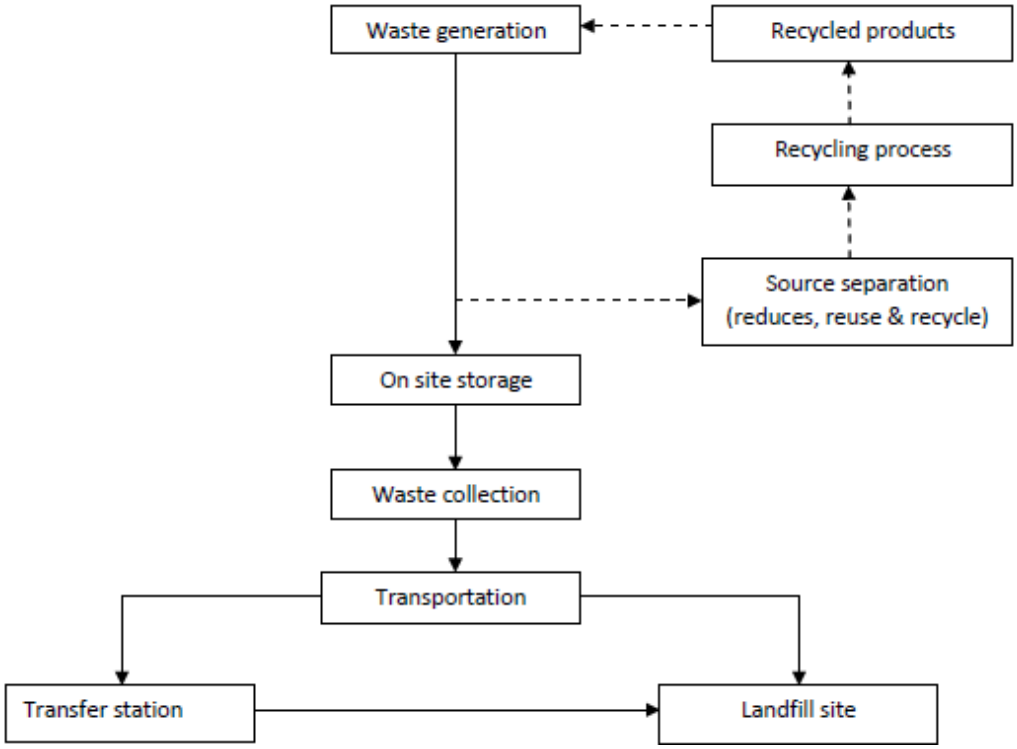
Recycling involves the separation of products from the waste stream and the use of waste as input products or raw materials.

Recovery refers to reclaiming particular components or materials or using waste to generate energy through incineration and/or biodegradation. Waste will be discharged to landfills where its quantity cannot be reduced further.

Treatment and disposal is the final, and least desirable step in the hierarchy of waste management steps. Waste treatment refers to any process that is designed to reduce the volume or hazard posed by waste. Disposal refers to responsible, environmentally friendly disposal of waste in accordance with the provisions of the National Environmental Management Act 107 of 1998 (NEMA).

Figure 3.2 illustrates the typical solid waste management systems that are implemented by municipalities across South Africa. The waste cycle comprises the collection of waste from the point of generation, transportation of the waste to a landfill or treatment site, treatment of waste, disposal and recycling (DEAT, 2003).

Figure 3.2: Municipal solid waste management system



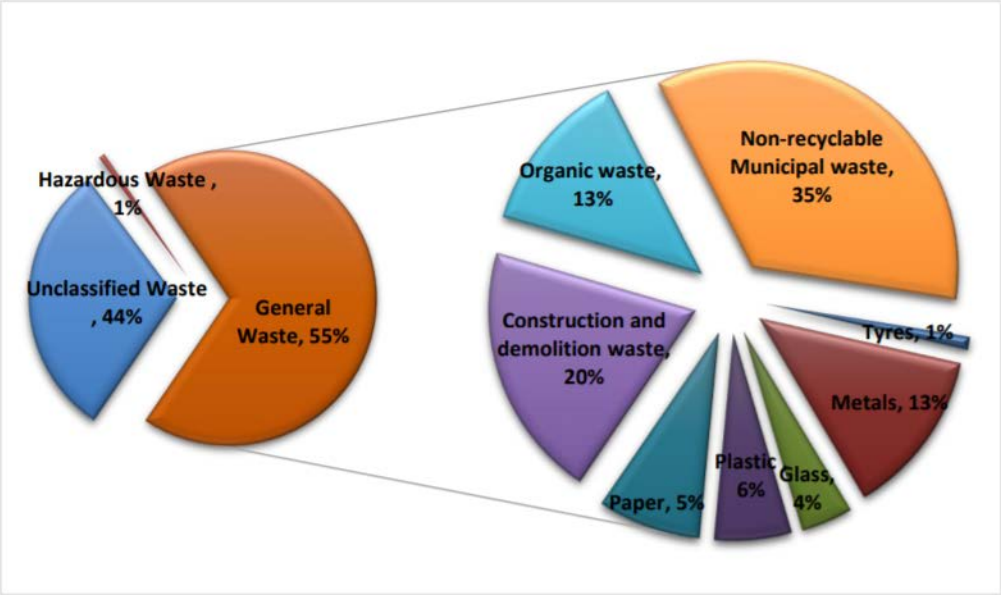
Source: DEAT, 2003

Waste is generated when materials that are perceived to have lost their value are either stored or collected. If waste is sorted at the source, it can be removed to be processed for further reduction, re-use or recycling. DEAT (2003) emphasises that the sorting of waste at the source is vital to increase recycling, re-use and reduction of waste and to minimize the volume of waste that will end up in landfill sites.

Waste collection is performed by a local authority or its contractors, and the services depend upon the community structures and geographic distribution of households. Kerbside collection is usually limited to formal areas. Communal collection is most common in informal areas, and requires households to place their waste in centrally located containers for collection.

The DEA's baseline study of 2012 (DEA, 2012) estimated that South Africa generated 95 million tonnes of general waste in 2011, of which approximately 10% was recycled. According to these estimates, general waste, which constituted 55% of all waste in 2011, was itself composed of non-recyclable municipal waste (35%), construction and demolition waste (20%), organic waste (13%), metals (13%), plastic (6%), paper (5%), glass (4%) and tyres (1%). This is presented in Figure 3.3. Backlogs in the identification, procurement, preparation and licensing of additional landfill sites could in future lead to serious waste disposal problems, once again emphasising the need to implement recycling programmes.

Figure 3.3: Waste profile for South Africa



Source: Bhailall, 2015

3.3 Roles and responsibilities

Solid waste management is predominantly a local government function. Section 156(1)(a) of the constitution, read with Schedule 5, assigns responsibility for refuse removal, refuse dumps, solid waste disposal and cleansing to local government. The local government function to provide sustainable delivery of services is, however, subject to national and provincial regulations and standards. The National Environmental Management: Waste Act, 2008 (Act no. 59 of 2008) stipulates that standards are required to 'give effect to the right to an environment that is not harmful to health and well-being'. The Act emphasises the development of an integrated waste planning system as the primary tool for cooperative governance in the sector in which National Government is responsible to maintain essential national standards, establish uniform norms and standards, promote and give effect to right to an environment that is not harmful to health or well-being, while provincial governments are tasked with the implementation of the national waste management strategy, and national norms and standards. Although local governments are permitted to develop their own standards, they should not be in conflict with national standards (Chisadza, 2015).

The National Waste Management Strategy (NWMS) was developed to assist local governments to sustainably implement the Waste Act and the waste hierarchy. NEMWA effectively provides municipalities with a monopoly over the provision of solid waste services, and private waste service providers are required to obtain permission from municipalities before they start any waste collection activities.

Table 3.1: Municipalities performing solid waste functions and alternative service providers by province, 2016

	Number of municipalities	With function	With infrastructure	Provide service	Outsource service	Number of consumer units receiving services
Western Cape	30	26	26	26	1	1 232 835
Eastern Cape	45	39	39	39	1	887 884
Northern Cape	32	27	27	27	0	239 946
Free State	24	20	20	20	0	686 499
KwaZulu-Natal	61	49	48	47	4	1 524 849
North West	23	19	17	17	1	567 087
Gauteng	12	10	10	10	1	3 307 566
Mpumalanga	21	18	18	18	0	662 854
Limpopo	30	25	24	24	1	467 013
South Africa	**278**	**233**	**229**	**228**	**9**	**9 576 533**

Source: Stats SA, 2017

Table 3.1 shows that 233 municipalities were authorised to perform solid waste management functions in 2016, while 228 actually performed these functions. Almost all municipalities that were assigned solid waste functions had infrastructure available to perform the required services. Although municipal departments are usually responsible to provide services, some municipalities, particularly metropolitan municipalities, outsourced the function to private entities. Nine municipalities outsourced solid waste management in 2016, down from 30 in 2005. Almost 9,6 million consumer units received solid waste services from municipalities in the country.

Large differences exist between metros and smaller municipalities and rural areas, and extending access remains a critical priority. The Waste Act therefore reiterates that future policies will increasingly focus on the provision of services in informal settlements and rural areas where the most vulnerable households are located.

3.4 Service standards

The Waste Act (RSA, 2008) recognises that South Africa is a developing country with a diversity of regions and that different service standards are appropriate in different settlement types and densities based on practicality and cost efficiency. Although landfills are often perceived to be the only solution, Mannie & Bowers (2014) warn that their viability could be undermined by large distances, low population densities, poverty, and differential waste generation. According to Mbande (1996), Lombard (1996) and Benting (2000) in National Treasury (2011) suburban households (0,8-3kg per person per day) generate much more waste than households in townships (0,2-0,8kg per person per day) and informal settlements (<0,2kg per person per day).

Although inadequate access remains the largest in rural areas where households typically dispose of waste themselves, domestic waste collection services are not always viable in rural areas where households often predominantly produce organic waste that can be disposed safely on-site (National Treasury, 2011).

According to the NEMA Waste Act (RSA, 2008), appropriate service levels may include:

- On-site disposal with regular and appropriate supervision in farms and remote rural areas with low population densities;

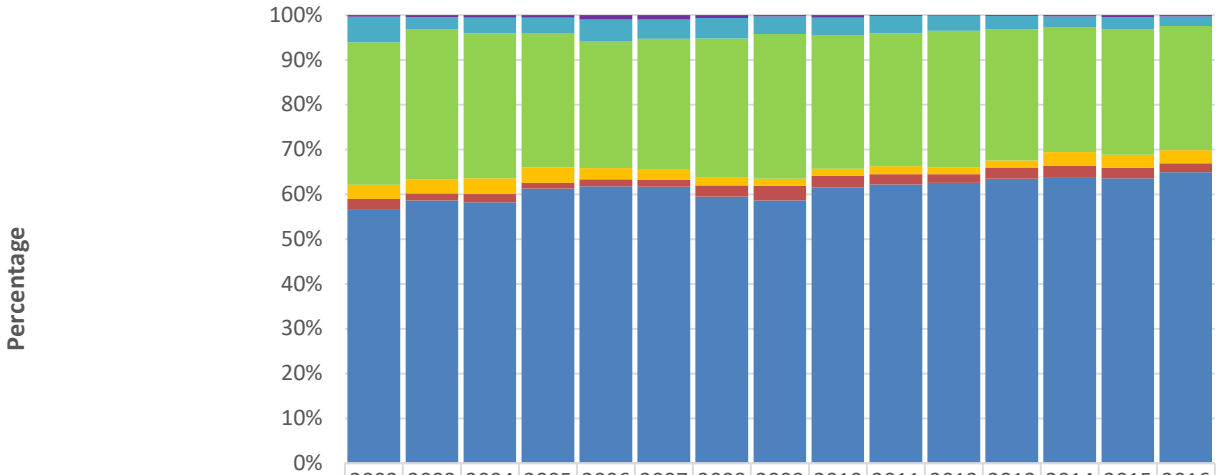
- Community transfer to central collection points in medium density settlements;
- Organised transfer to central collection points and/or kerbside removal in high-density settlements.

Although South African local government is well regulated by an overall framework set out by the Local Government Municipal Structure Act, 1998; Municipal Systems Act, 2000; and the Municipal Finance Management Act, 2003, the nature of the services that local governments can provide is impacted by affordability; municipal capacity; quality and nature of waste generated; climate; availability of storage; road conditions, and the availability of sufficient waste volumes to ensure that staff and equipment is used optimally.

3.5 Access to solid waste management services

Solid waste management and service delivery systems can make critical contributions to public health, environmental sustainability, economic development and poverty reduction. Effective solid waste management systems can contribute to improving public health outcomes through reducing opportunities for disease spreading vermin to thrive, such as occurs at unregulated local dumpsites. They contribute to enhancing environmental quality by protecting watercourses, ground water and preventing illegal dumping and littering. Well-designed solid waste management systems support both higher levels of economic activity and can contribute directly to poverty alleviation through job creation. Conversely, a failure to provide effective solid waste systems is felt most severely by poor households.

Figure 3.4: Percentage distribution of household waste removal, 2002-2016

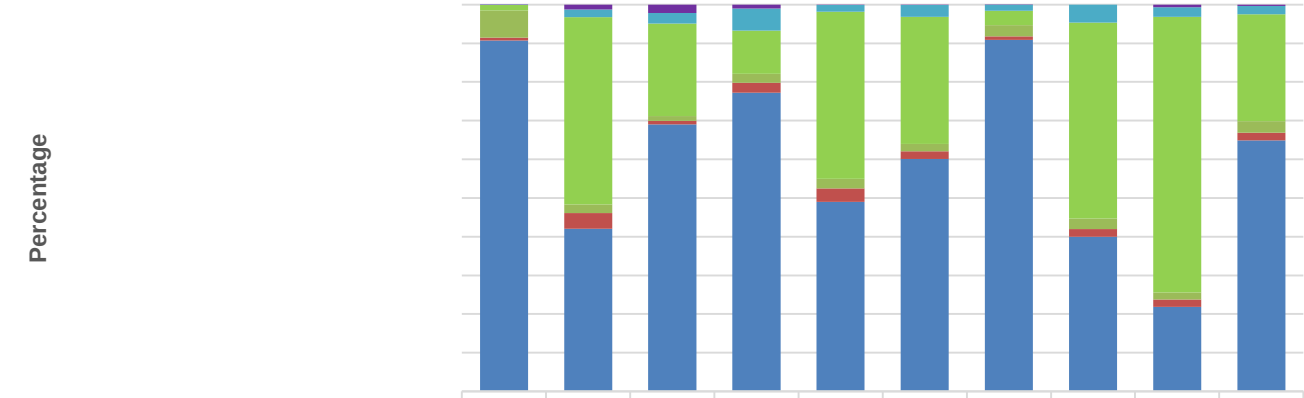


	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Other	0,4	0,5	0,6	0,6	1,0	1,0	0,7	0,3	0,6	0,2	0,2	0,2	0,3	0,4	0,3
Dump or leave rubbish anywhere	5,7	2,8	3,6	3,4	4,8	4,3	4,6	3,9	3,9	3,9	3,3	3,0	2,4	2,8	2,1
Own refuse dump	31,8	33,5	32,4	30,0	28,4	29,1	30,9	32,2	29,8	29,6	30,4	29,2	28,0	28,0	27,7
Communal refuse dump	3,1	3,1	3,5	3,4	2,5	2,4	1,9	1,6	1,6	1,8	1,6	1,6	3,1	2,9	3,0
Removed less often than once per week	2,3	1,5	1,9	1,3	1,6	1,5	2,4	3,3	2,7	2,2	2,0	2,6	2,5	2,4	2,0
Removed at least once per week	56,7	58,7	58,2	61,2	61,7	61,7	59,5	58,6	61,5	62,2	62,5	63,5	63,8	63,5	64,9

Much progress has been made since 2002 to ensure public and environmental health. Figure 3.4 shows that the percentage of households for which waste was removed at least once per week increased from 56,7% in 2002 to 64,9% in 2016, while the percentage of households that had to rely on their own or communal rubbish dumps, or who had no facilities at all, decreased over the same period.

The national figures, however, hide large provincial and geographical variations. Provincial and geographical discrepancies are presented in Figures 3.5 and 3.6 respectively.

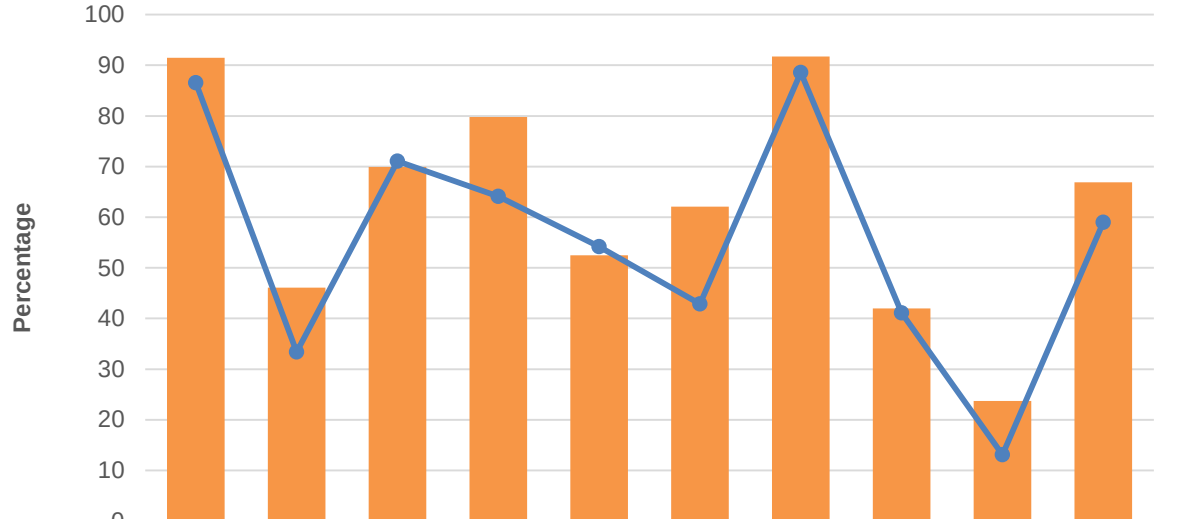
Figure 3.5: Percentage distribution of household waste removal and disposal by province, 2016



	WC	EC	NC	FS	KZN	NW	GP	MP	LP	RSA
Other	0,1	1,2	2,2	1,1	0,1	0,1	0,1	0,0	0,6	0,3
Dump or leave rubbish anywhere	0,1	2,0	2,7	5,7	1,7	3,1	1,5	4,6	2,5	2,1
Own refuse dump	1,4	48,4	24,0	11,2	43,2	32,9	3,8	50,7	71,3	27,7
Communal refuse dump	7,1	2,2	1,2	2,3	2,5	1,9	2,9	2,7	1,9	3,0
Removed less often than once per week	0,7	4,1	0,9	2,6	3,5	2,0	0,9	2,0	1,8	2,0
Removed by municipality atleast once a week	90,7	42,0	69,0	77,3	49,0	60,1	90,9	40,0	21,9	64,9

Whereas refuse was removed weekly or less regularly for more than two-thirds (66,9%) of South African households in 2016, Figure 3.5 shows that only 23,7% of households in Limpopo, 42% of households in Mpumalanga, and 46,1% of households in Eastern Cape reported the same service. More than seven-tenths (71,3%) of households in Limpopo used their own refuse dump to dispose of solid waste, followed by households in Mpumalanga (50,7%), Eastern Cape (48,4%), KwaZulu-Natal (43,2%) and North West (32,9%).

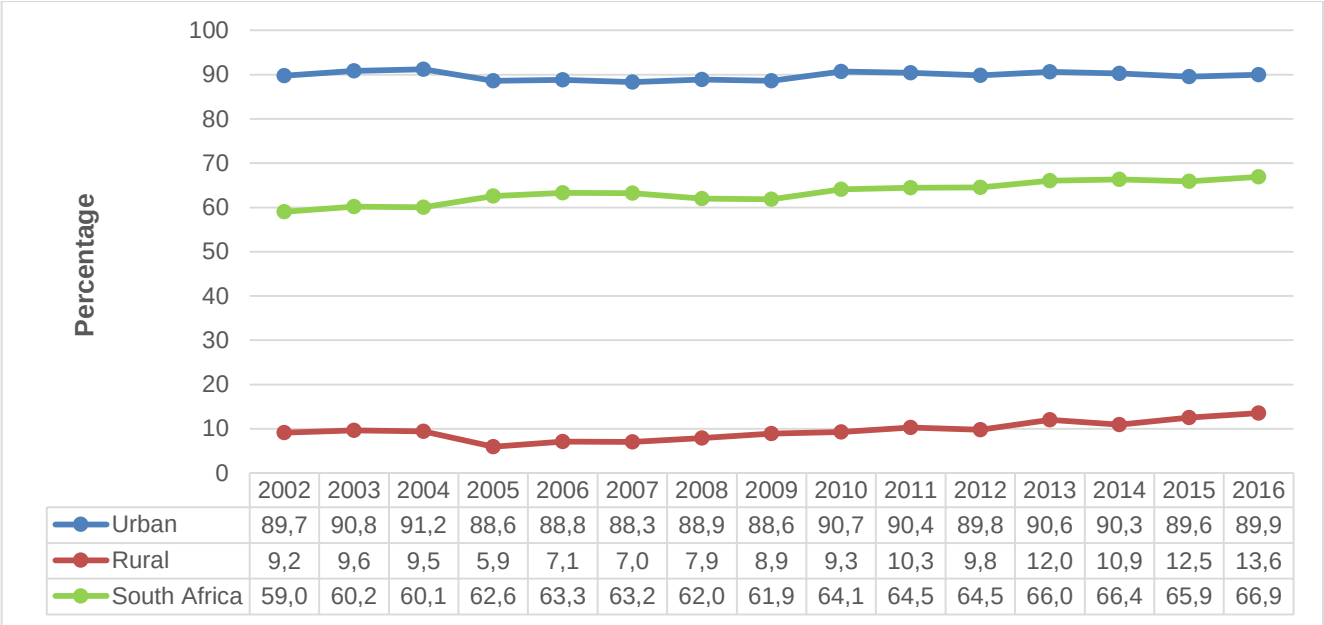
Figure 3.6: Percentage of households receiving solid waste management services by province, 2002 and 2016



	WC	EC	NC	FS	KZN	NW	GP	MP	LP	RSA
2016	91,5	46,1	69,9	79,8	52,5	62,1	91,8	42,0	23,7	66,9
2002	86,5	33,4	71,1	64,1	54,2	42,9	88,6	41,1	13,1	59,0

Figure 3.6 presents the percentage of households that had access to solid waste management services per province in 2002 and 2016. The figure shows little change in Northern Cape, KwaZulu-Natal, Gauteng and Mpumalanga. The largest increase for households receiving solid waste management services was recorded for North West (19,2 pp), Free State (15,7 pp), Eastern Cape (12,7 pp) and Limpopo (10,6 pp). KwaZulu-Natal (-1,7pp) and Northern Cape (1,2 pp), however, experienced a decline in the percentage of households that received solid waste management services during this period.

Figure 3.7: Percentage distribution of households receiving solid waste management services by geotype, 2002-2016



	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Urban	89,7	90,8	91,2	88,6	88,8	88,3	88,9	88,6	90,7	90,4	89,8	90,6	90,3	89,6	89,9
Rural	9,2	9,6	9,5	5,9	7,1	7,0	7,9	8,9	9,3	10,3	9,8	12,0	10,9	12,5	13,6
South Africa	59,0	60,2	60,1	62,6	63,3	63,2	62,0	61,9	64,1	64,5	64,5	66,0	66,4	65,9	66,9

Figure 3.7 reaffirms the findings of figure 3.5. Households living in rural areas were least likely to receive solid waste management services whilst such services were almost universal for households living in urban areas.

Figure 3.8: Percentage of households receiving solid waste management services by metropolitan area, 2016

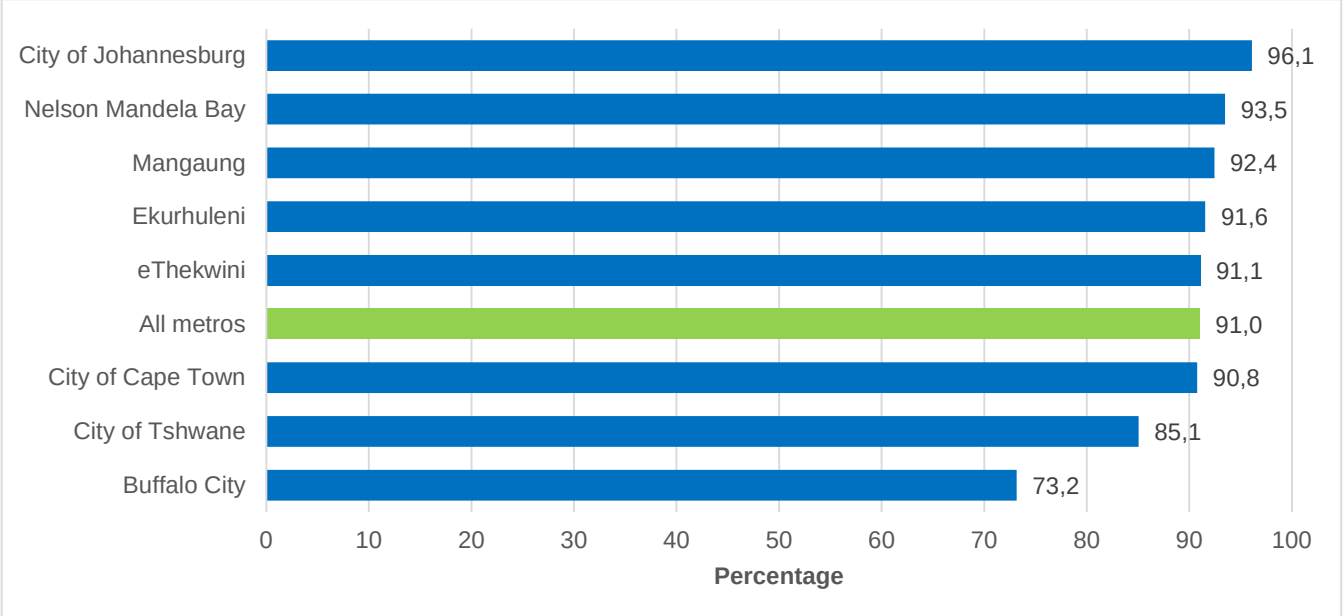
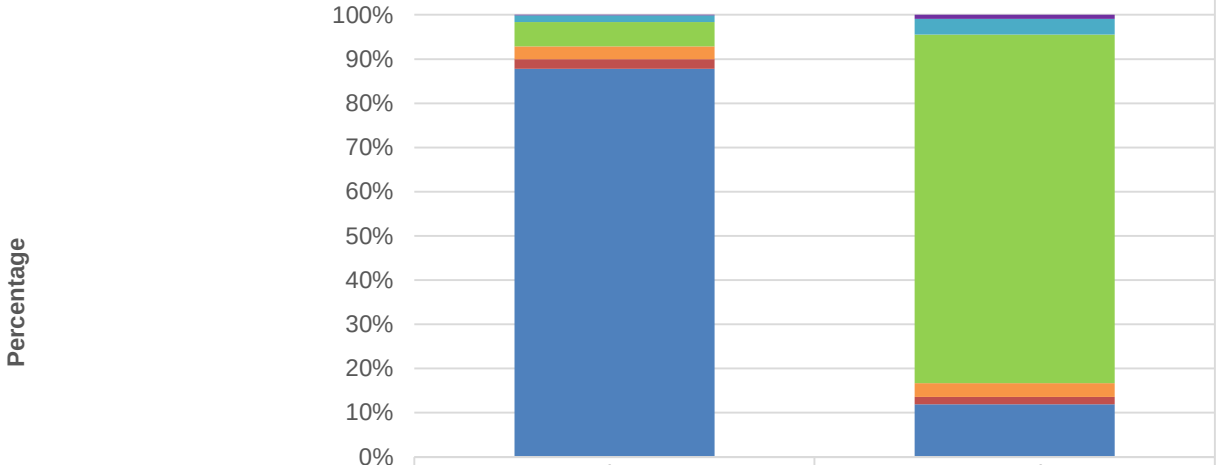


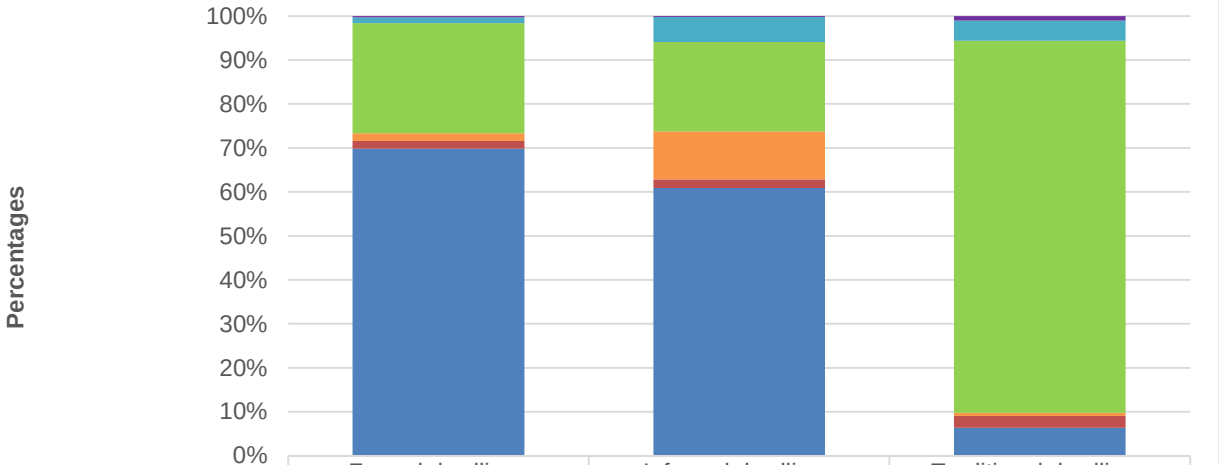
Figure 3.8 shows that 91% of all households in metropolitan areas received solid waste management services. Solid waste management services were most common in the City of Johannesburg (96,1%), Nelson Mandela Bay (93,5%), Mangaung (92,4%), Ekurhuleni (91,6%) and eThekwini (91,%). Less than three-quarters of households living in Buffalo City (73,2%) reported receiving solid waste management services.

Figure 3.9: Percentage distribution of household waste disposal by geotype, 2016



	Urban	Rural
Other	0,1	0,9
Dump or leave rubbish anywhere	1,5	3,5
Own refuse dump	5,5	78,9
Communal refuse dump	2,9	3,2
Removed less often than once per week	2,2	1,6
Removed by municipality atleast once a week	87,8	12,0

Figure 3.10: Percentage distribution of household waste disposal by dwelling type, 2016

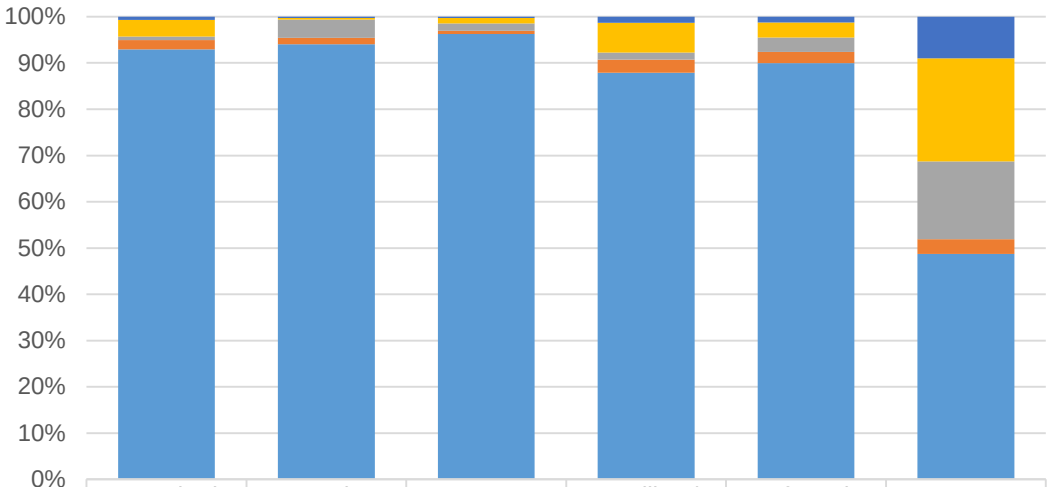


	Formal dwellings	Informal dwellings	Traditional dwellings
Other	0,3	0,2	1,1
Dump or leave rubbish anywhere	1,4	5,7	4,6
Own refuse dump	25,0	20,3	84,6
Communal refuse dump	1,7	10,9	0,7
Removed less often than weekly	1,8	2,0	2,6
Removed weekly	69,8	60,9	6,4

Household access to solid waste removal also varied greatly between urban and rural households. Figure 3.9 shows that 87,8% of households that resided in urban areas had access to weekly waste removal while 78,9% of rural households still depended on household refuse dumps.

Nearly 70% of households that lived in formal dwellings reported that their waste was removed at least once per week compared to approximately 61% of households living in informal dwellings, and only 6,4% of households living in traditional dwellings. Figure 3.10 shows that utilisation of own refuse dump was most common amongst households living in traditional dwellings (84,6%) and least common in informal areas. More than one-tenth of households living in informal dwellings used communal refuse dump.

Figure 3.11: Percentage of urban household waste disposal by main dwelling, 2016

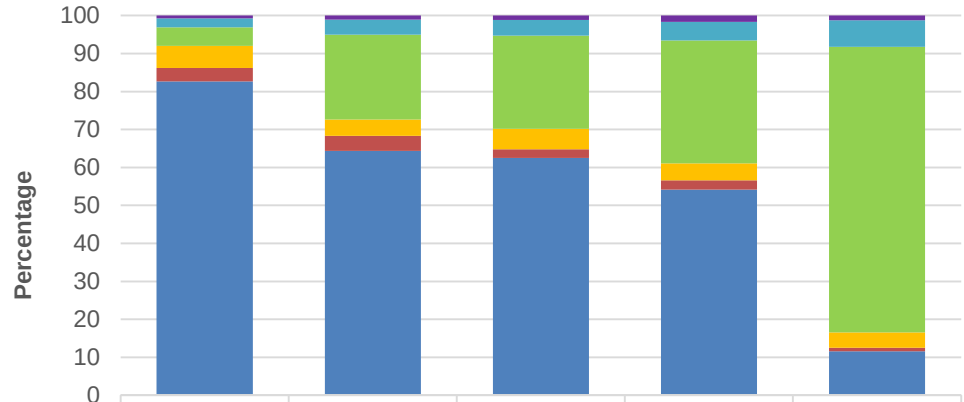


	Detached single unit housing	Semi-detached dwelling	Flat or apartment	Dwelling / room / flat in backyard	Informal backyard and other	Informal dwellings
Other	0,7	0,3	0,3	1,3	1,3	9,0
Own refuse dump	3,6	0,4	1,2	6,4	3,3	22,3
Communal refuse dump	0,7	4,0	1,5	1,6	3,1	16,8
Removed less often	2,0	1,4	0,7	2,8	2,4	3,2
Removed once per week	92,9	94,1	96,3	87,9	89,9	48,7

A number of interesting observations emerge in Figure 3.11 when the three dwelling categories used in Figure 3.10 are unbundled for urban households. The categories are outlined in Appendix 8.1.

According to Figure 3.11 refuse removal was quite common in detached single unit housing (94,9%), semi-detached dwellings (95,5%) and flats or apartments (97%), and least prevalent amongst households living in informal dwellings situated in informal areas (51,9%). Communal refuse dumps largely serviced semi-detached dwellings and flats that were without refuse removal services. Although 6,3% of households that lived in backyard dwellings indicated that they used their own refuse dumps, this was true for 22,3% of households living in informal areas. As expected solid waste service provided to households that lived in formal and informal backyard structures were very similar, confirming the use of services provided to the host dwelling unit by occupants of backyard structures.

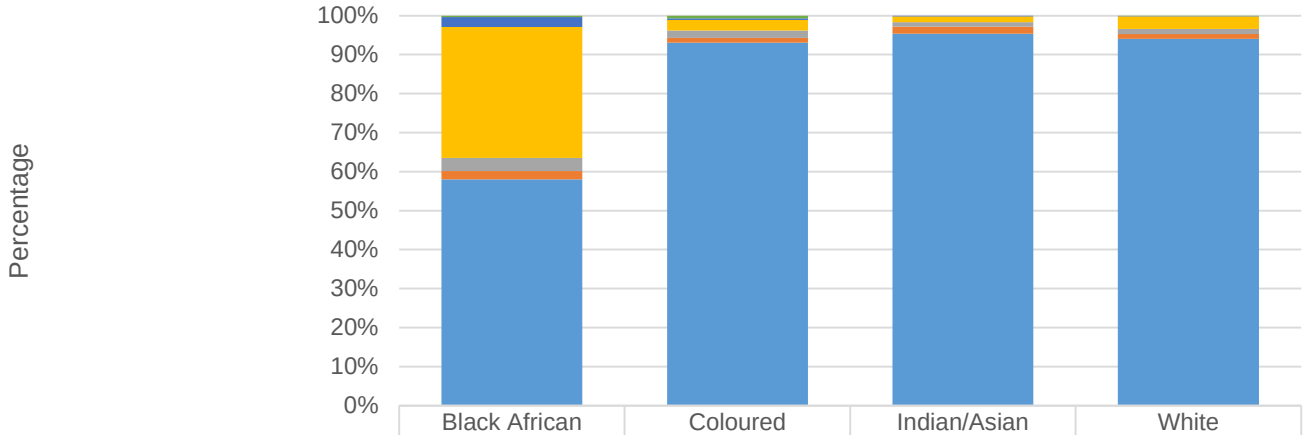
Figure 3.12: Percentage distribution of household waste disposal by municipal category, CS 2016



	Metropolitan municipality	Secondary City	Large Town	Small Town	Rural Municipality
Dump or leave rubbish anywhere	0,8	1,1	1,2	1,6	1,3
Own refuse dump	2,4	4,0	4,1	4,9	7,0
Central collection point	4,9	22,3	24,5	32,4	75,2
Communal refuse dump	5,8	4,3	5,4	4,4	4,1
Removed less often than once a week	3,6	4,0	2,3	2,5	1,0
Removed at least once a week	82,7	64,4	62,5	54,2	11,6

Figure 3.12 shows that waste removal services were most common in the large, metropolitan municipalities (82,7%) and that it became less common as municipalities became more rural. Only 11,6% of households in rural (B4) municipalities, for instance, received refuse removal services at least once a week. Inversely, the percentage of households that used their own refuse dumps increased as municipalities become more rural, growing from 4,9% for metropolitan municipalities to three-quarters for the most rural municipalities. Households that had no waste disposal were also most common in the most rural municipalities.

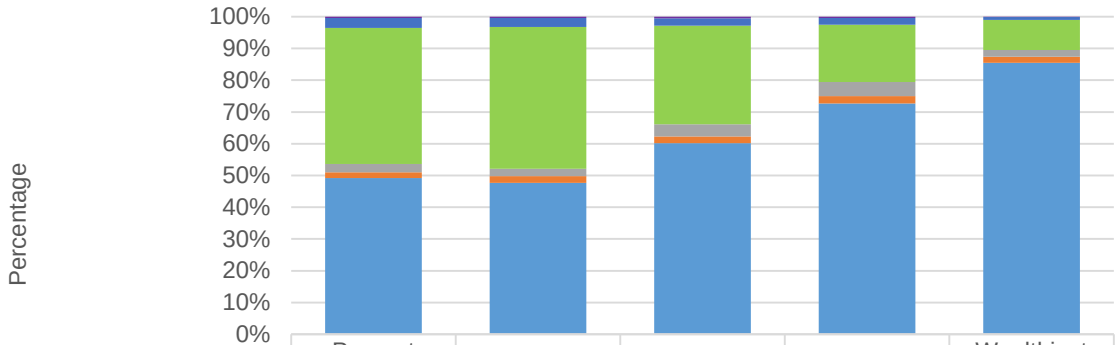
Figure 3.13: Percentage distribution of household waste disposal by population group of the head of the household, 2016



	Black African	Coloured	Indian/Asian	White
Other	0,3	0,7	0,0	0,1
Dump or leave rubbish anywhere	2,6	0,4	0,2	0,1
Own refuse dump	33,6	2,7	1,5	3,2
Communal refuse dump	3,3	1,9	1,2	1,3
Removed less regularly	2,2	1,2	1,8	1,2
Removed at least once a week	58,0	93,1	95,4	94,1

The percentage distribution of the mode of household waste disposal by population group of the head of the household is presented in figure 3.13. More than nine-tenths of households headed by Indian/Asians (95,4%), Whites (94,1%) and Coloureds (93,1%) had access to weekly refuse removal services, most likely because most of these households are concentrated in urban areas. By contrast, only 60,2% of households by Black Africans indicated that their waste was removed by the municipality on a weekly basis, or less regularly. One-third (33,6%) of black African headed households still depend on household refuse dumps, while a further 2,6% of these households indicated that they had nowhere to dispose of their refuse. The high estimates for black African households are closely associated with poverty and the concentration of these households in rural and informal areas with substandard solid waste services.

Figure 3.14: Percentage distribution of household waste disposal by Income quintile, 2016

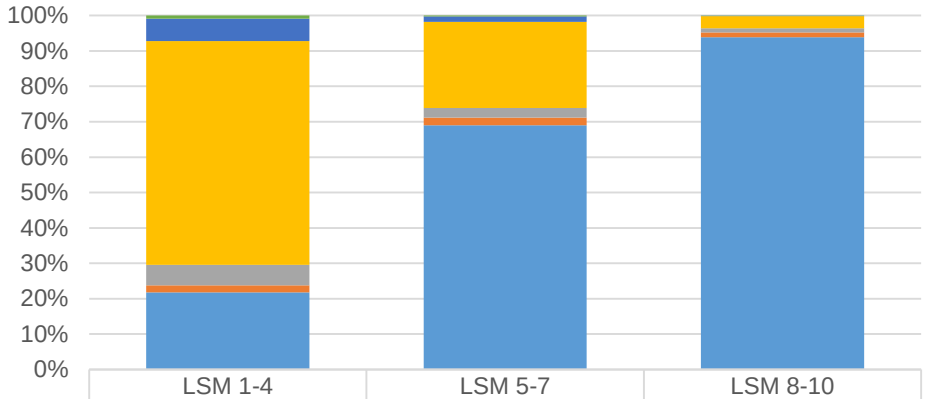


	Poorest quintile	Quintile 2	Quintile 3	Quintile 4	Wealthiest quintile
Other	0,4	0,4	0,6	0,4	0,2
Dump or leave rubbish anywhere	3,2	2,9	2,3	2,1	0,9
Own refuse dump	42,8	44,7	31,0	18,1	9,5
Communal refuse dump	2,7	2,3	3,8	4,5	2,1
Removed less regularly	1,8	2,1	2,1	2,4	1,9
Removed at least once a week	49,2	47,7	60,2	72,7	85,5

The relative shares of waste disposal modes by income quintiles are presented in Figure 3.14. The figure suggests a relationship between household income and waste removal. The percentage of households with access to kerbside refuse removal increased from 51% of households in quintile 1 to 87,4% of households in the wealthiest quintile. Inversely, a much larger proportion of poor households in quintile 1 (42,8%) continue to rely on household refuse dumps than wealthier households in the top quintile (9,5%).

Another way of looking at the relationship between solid waste management and socio-economic status is by using Living Standard Measures (LSMs). Although the South African Advertising Research Foundation's (SAARF) Universal LSM (SU-LSM) is a market segmentation tool that assists businesses to direct their marketing activities, the tool is useful to divide a large population into smaller, relatively homogeneous groups according to their living standards rather than their income. The LSM is therefore a wealth measure that uses criteria such as degree of urbanisation and ownership of certain assets to create a ten-point scale (LSM-groups 1-10) where LSM-group 1 refers to those of lowest status, and LSM-group 10 refers to those of highest status.

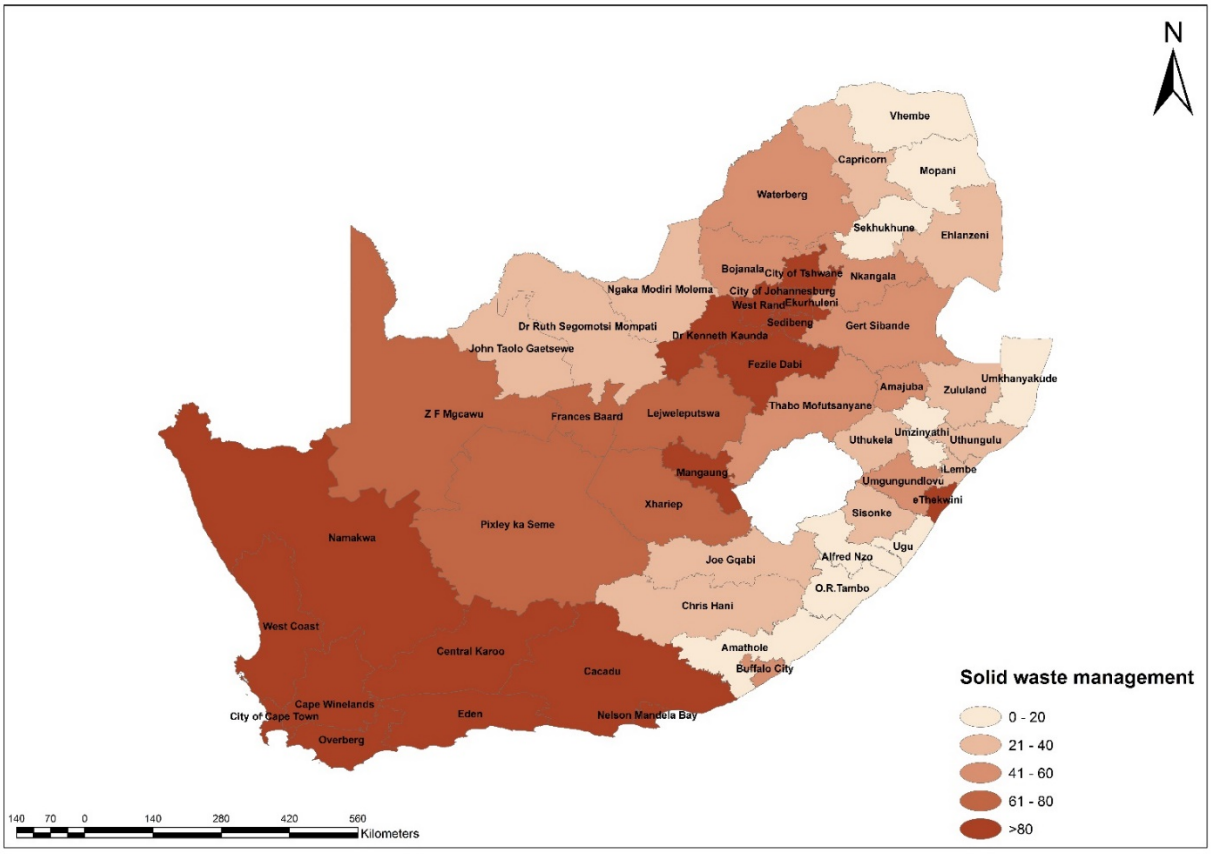
Figure 3.15: Percentage distribution of household waste disposal by broad LSM category, 2016



	LSM 1-4	LSM 5-7	LSM 8-10
Other	0,9	0,3	0,1
Dump or leave rubbish anywhere	6,3	1,5	0,1
Own refuse dump	63,3	24,4	3,4
Communal refuse dump	5,7	2,7	1,1
Removed less regularly	2,0	2,2	1,4
Removed at least once a week	21,8	69,0	93,9

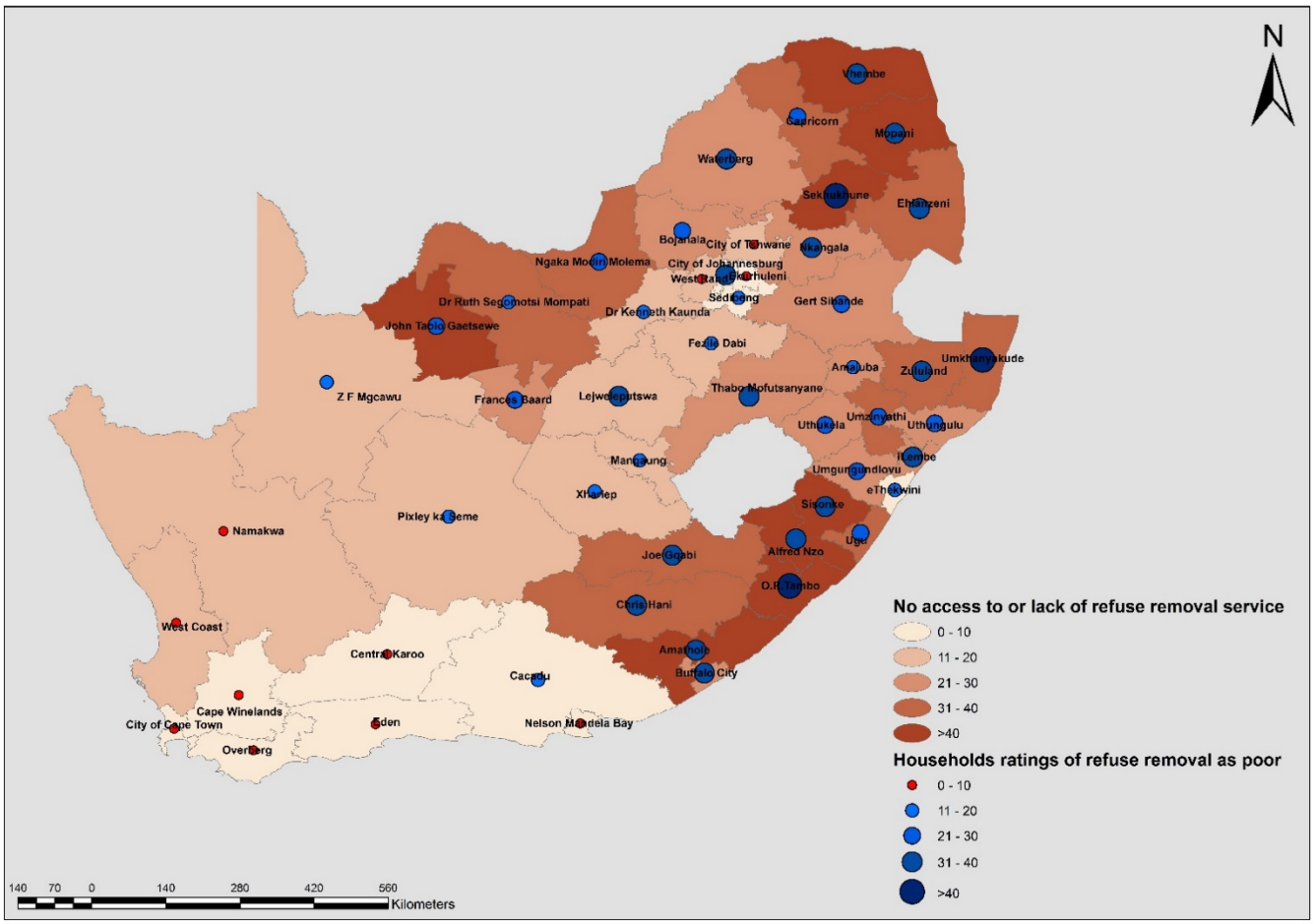
The study divides the 10 LSMs into three categories, namely: Low (LSM 1-4), Intermediate (LSM 5-7) and High (LSM 8-10). Figure 3.15 shows that refuse removal services were most common for high-LSM households (93,9%) and least common in low-LSM households (21,8%). Inversely, almost two-thirds (63,3%) of low-LSM households depended on household refuse dumps compared to 3,4% of high-LSM households. It is notable that 6,3% of low-LSM households had no access to any type of refuse disposal.

Map 3.1: Households receiving solid waste management services by District Council, CS 2016



The percentage of households that received solid waste service (refuse removal each week, or less regularly) per district is presented in Map 3.1. The map shows that solid waste services were most common in districts around Gauteng, Western Cape, the Western seaboard, and eThekwini. This is in line with the findings in Figure 3.5 which shows that, according to GHS 2016, 91,8% and 91,4% of households that lived in Gauteng and Western Cape respectively received solid waste management services. Solid waste services were much less common outside the metropolitan areas, particularly along the Eastern seaboard, Limpopo and North West.

Map 3.2: Percentage of households with no access to or that do not use waste disposal services and those who perceived waste disposal services as "poor" by District Councils, CS 2016



Map 3.2 suggests the existence of a positive relationship between 'no access to, or lack of refuse removal services' and household rating of refuse removal services. The results of Community survey 2016 show that generally households that lived in Western Cape and Gauteng were most likely to receive waste management services and were least likely to rate the services they receive as 'poor'. By contrast, households that lived in the largely rural district municipalities of the Eastern Cape, Limpopo, some parts of KwaZulu-Natal and North West not only reported poor access to waste management services, but a higher percentage also rated services as 'poor'.

3.6 Payment for solid waste management services

Although municipalities have shown a commitment to addressing backlogs in the provision of solid waste services, the expansion of these services has, ironically, led to a decline in the average revenue per consumer as more poor households are serviced. Most municipalities have therefore implemented free basic refuse services in which

municipalities subsidise services by, usually, implementing a self-selection process such as a tariff based or means-tested subsidy (National Treasury, 2011). A national policy for the provision of basic refuse removal services to indigent households was approved in 2010 (DEA, 2011). The growth in the number of consumer units and the uptake of free basic services are presented in Table 3.2.

Table 3.2: Number of consumer units that received free solid waste management services in 2015 and 2016

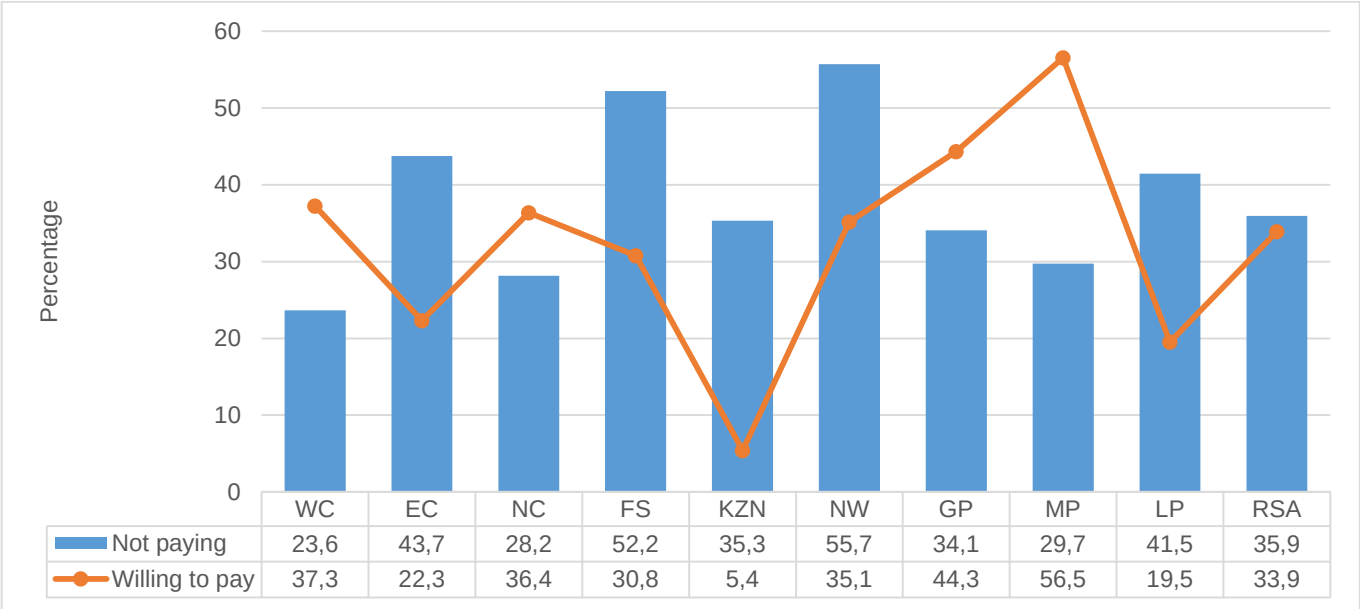
	2015			2016		
	Number of consumer units that received solid waste management services	**Number of consumer units that received free solid waste management services**	**Percentage that benefitted (%)**	**Number of consumer units that received solid waste management services**	**Number of consumer units that received free solid waste management services**	**Percentage that benefitted (%)**
Western Cape	1 215 845	561 755	46,2	1 232 835	620 399	50,3
Eastern Cape	794 435	223 932	28,2	887 884	274 890	31,0
Northern Cape	235 291	64 327	27,3	239 946	71 503	29,8
Free State	659 242	133 947	20,3	686 499	137 522	20,0
KwaZulu-Natal	4 512 895	683 842	45,2	1 524 849	717 472	47,1
North West	549 097	88 712	16,2	567 087	92 404	16,3
Gauteng	3 298 101	360154	10,9	3 307 566	693 632	21,0
Mpumalanga	631 802	92 161	14,6	662 854	102 708	15,5
Limpopo	452 776	90 281	19,9	467 013	65 393	14,0
South Africa	**9 349 484**	**2 299 111**	**24,6**	**9 576 533**	**2 775 923**	**29,0**

Source: Stats SA, 2017: 7

Table 3.2 shows that 29% of all consumer units (approximately 2,8 million) received free basic solid waste management services in 2016. The increase of 4,4 percentage points between 2016 and 2015 when 2,3 million consumer units received free basic services can be attributed to changes in the targeting mechanism utilised by municipalities.

While some households can legitimately not pay for refuse removal services, other households, for reasons known to them, do not pay, and sometimes do not intend to pay for these services. This is presented in Figure 3.16.

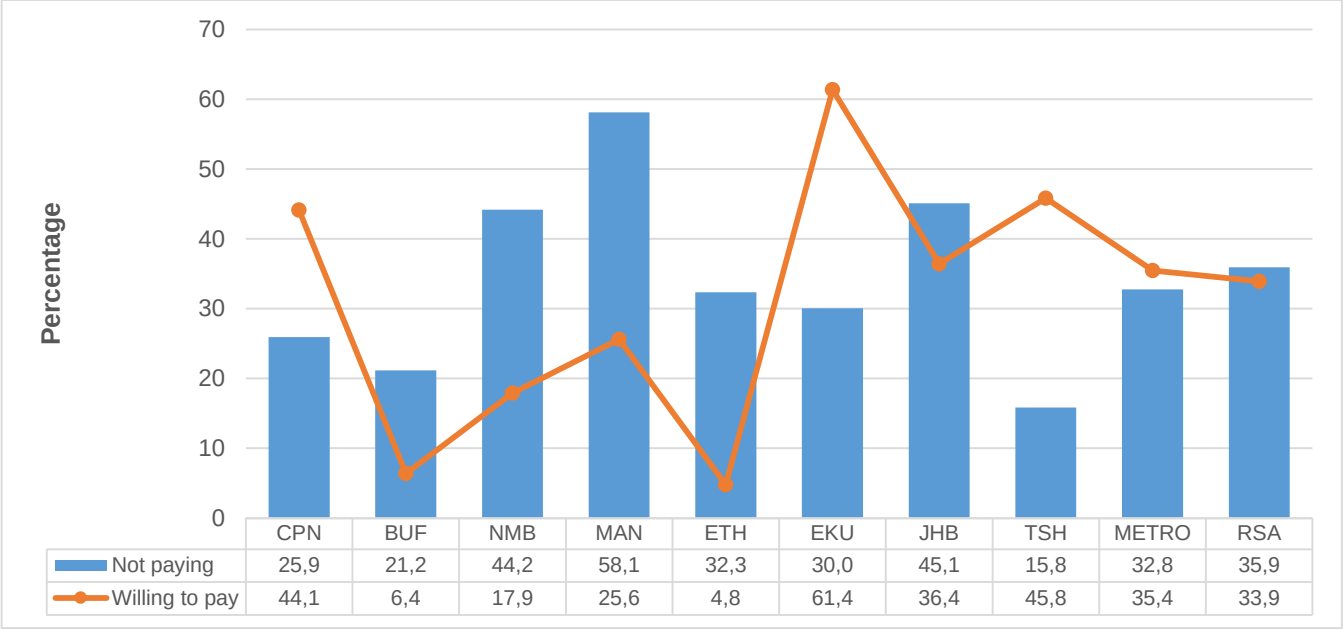
Figure 3.16: Percentage of households living in formal dwellings not paying and willing to pay for solid waste management services by province, 2016



	WC	EC	NC	FS	KZN	NW	GP	MP	LP	RSA
Not paying	23,6	43,7	28,2	52,2	35,3	55,7	34,1	29,7	41,5	35,9
Willing to pay	37,3	22,3	36,4	30,8	5,4	35,1	44,3	56,5	19,5	33,9

Figure 3.16 shows the percentage of households that lived in formal dwellings and who were not paying for solid waste management services as well as those who did not pay, but were willing to pay for such services. The figure indicates that more than one-half of households that lived in formal dwellings in North West (55,7%) and Free State (52,2%) were not paying for solid waste management services despite receiving such services. Only 35% and 31% respectively indicated that they were willing to pay for the services in these provinces. Over one-third (35,3%) of households that lived in formal dwellings in KwaZulu-Natal reported not paying for solid waste management services. A mere 5,4% were willing to pay. This figure further indicates that there is a strong relationship between non-payment and willingness to pay. Households living in Northern Cape, Western Cape, Mpumalanga and Gauteng recorded lowest percentages for non-payment, however, when it comes to willingness to pay they recorded the largest percentages.

Figure 3.17: Percentage of households living in formal dwellings not paying and willing to pay for solid waste management services by metropolitan area, 2016



	CPN	BUF	NMB	MAN	ETH	EKU	JHB	TSH	METRO	RSA
Not paying	25,9	21,2	44,2	58,1	32,3	30,0	45,1	15,8	32,8	35,9
Willing to pay	44,1	6,4	17,9	25,6	4,8	61,4	36,4	45,8	35,4	33,9

Non-payment for solid waste management services was most prevalent in households that lived in formal dwellings in Mangaung (58,1%), Johannesburg (45,1%) and Nelson Mandela Bay (44,2%). Only five per cent of households that lived in formal dwellings and which indicated that they were not paying for waste removal services in eThekwini municipality were willing to pay. Of just over one-quarter of households that did not pay for waste removal services in Buffalo City, only 6,4% indicated willingness to pay. This is presented in Figure 3.17.

Figure 3.18: Percentage of households living in formal dwellings not paying and willingness to pay for solid waste management services by geotype, 2016

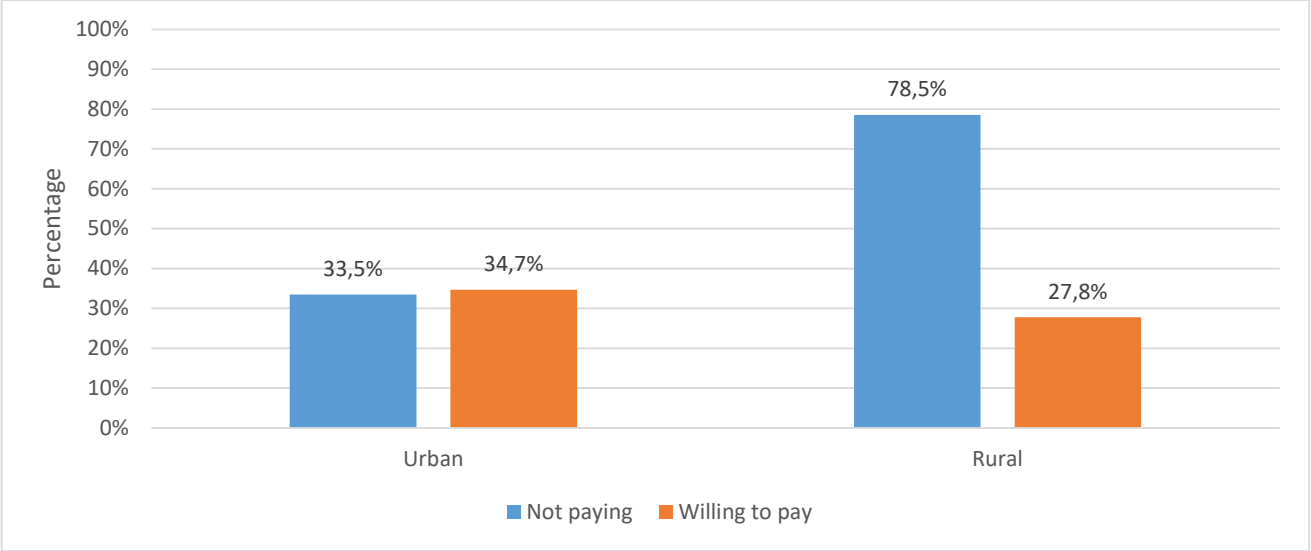
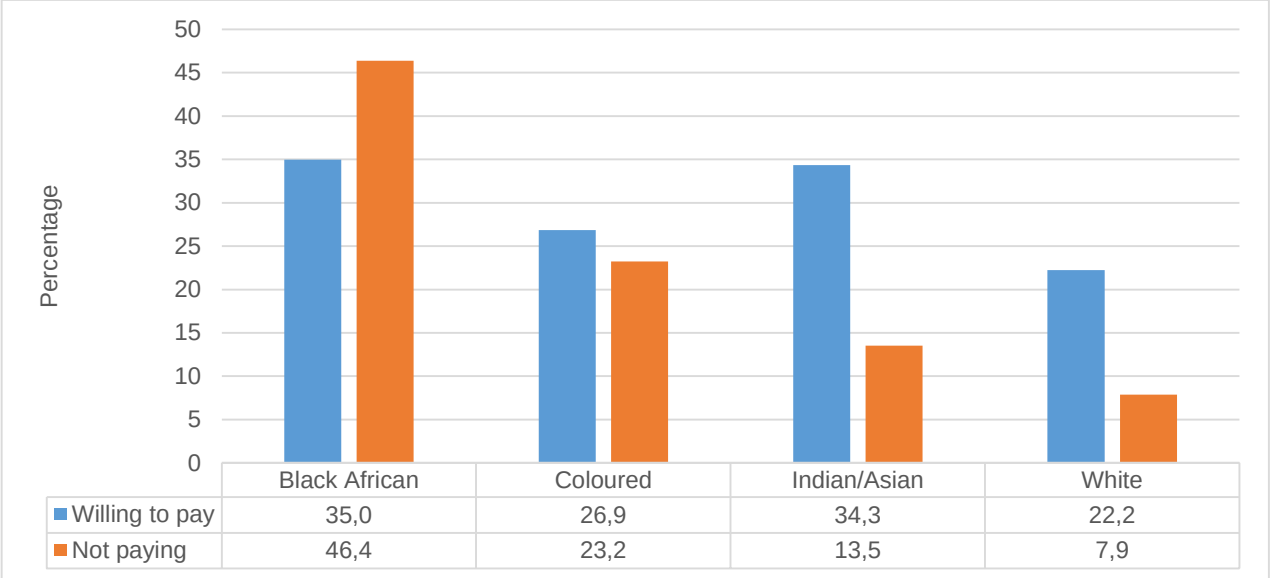


Figure 3.18 shows that just one-third of households that lived in formal dwellings in urban areas were not paying for solid waste management services. Of the urban households that did not pay, 34,7% were willing to pay for the service. In rural areas, nearly four-fifths of households that lived in formal dwellings were not paying for solid waste management services. Of those that did not pay, only 27,8% were, in principle, willing to pay.

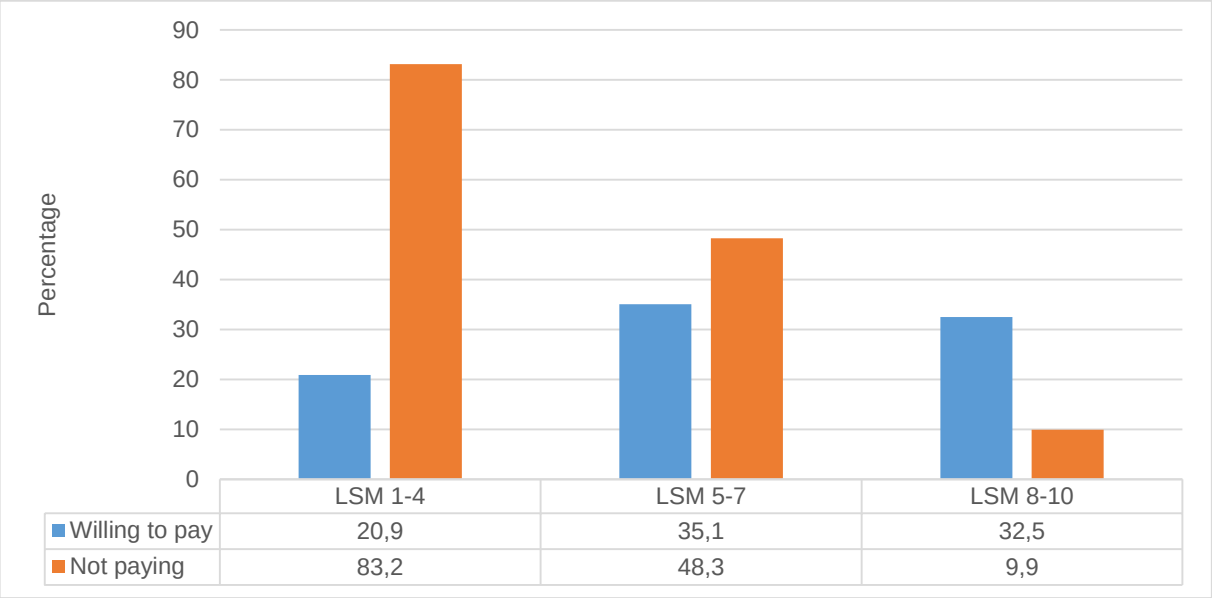
Figure 3.19: Percentage of households living in formal dwellings not paying and willing to pay for solid waste management services by population group of the head of the household, 2016



	Black African	Coloured	Indian/Asian	White
Willing to pay	35,0	26,9	34,3	22,2
Not paying	46,4	23,2	13,5	7,9

Figure 3.19 shows that a much higher percentage of black African headed households did not pay for refuse removal services than households headed by individuals from other population groups. While 46,4% of black African-headed households did not pay, less than one-tenth (7,9%) of white-headed household did the same. Interestingly, the differences between households that did not pay in terms of whether they were willing to pay for services were not as big as for non-payment. Households headed by black African (35,0%) and Indian/Asian (34,3%) households showed the greatest resistance, while white- (22,2%) and coloured-headed (26,9%) were most agreeable.

Figure 3.20: Percentage of households living in formal dwellings not paying and willing to pay for solid waste management services by broad LSM category, 2016



	LSM 1-4	LSM 5-7	LSM 8-10
Willing to pay	20,9	35,1	32,5
Not paying	83,2	48,3	9,9

Figure 3.20 shows that non-payment for solid waste management services declined for the households living in formal dwellings with a decrease in household wealth. While 83,2% of households in the low-LSM category did not pay for refuse removal services, this was only the case for 9,9% of households in the high-LSM category. Inversely, the willingness to pay for services was much higher for wealthier households.

3.7 Multivariate analysis

It is not always clear from the descriptive analysis whether there is a relationship between the dependent and independent variables. This necessitates doing a multivariate analysis between the variables. Since the dependent variable is dichotomous in nature, logistic regression is recommended for this study. A logistic regression model typically predicts the probability of an event happening (1) or not happening (0). The model calculates an odds ratio, which is the ratio of the odds of an event occurring or not occurring. In this study we are interested in modelling the probability that households will receive solid waste management services or not. Therefore the dependent or predictor variable is solid waste management services (where 1 denotes the probability of not receiving solid waste management services and 0 denotes the probability of receiving solid waste management services). Similarly the second logistic regression will model the probability of households living in formal dwellings not paying for solid waste management services received vs. households living in formal dwellings paying for solid waste management services received.

Table 3.3: Variables in the multivariate analysis

Variable	Coding
Dependent Variable (solid waste management services)	0 = Households not receiving solid waste management services 1 = Household receiving solid waste management (consists of refuse removed at least once a week and less often than once per week)
Dependent Variable (Households living in formal dwellings not paying for solid waste management services)	0 = Not paying for solid waste management services 1 = Paying for solid waste management services
Geographic location	1 = Urban area 2 = Rural area (consist of traditional areas and farms)
Dwelling type	1 = Formal dwellings (Includes: House, flat, cluster house in a complex, townhouse, semi-detached house, room or and flatlet in a property) 2 = Traditional Dwellings (Structures made of traditional materials) 3 = Informal dwellings (consists of shack in back yard and shack not in the backyard)
LSM	1 = LSM 1-4 2 = LSM 5-7 3 = LSM 8-10
Income quintile	1 = Poorest quintile 2 = Quintile 2 3 = Quintile 3 4 = Quintile 4 5 = Wealthiest quintile
Population Group of the head of the household	1 = Black African 2 = Coloured 3 = Indian / Asian 4 = White
Households experiencing Littering	0 = Not experiencing littering 1 = Experiencing littering
Experience of irregular or no waste removal	0 = No waste removal services 1 = Availability of waste removal services
Metropolitan Municipality	0=Living in non-metropolitan municipality 1=Living in metropolitan municipality

The variables used in the multivariate analyses for solid waste removal, and paying for solid waste services, are presented in Table 3.2 Independent variables includes: Province or residence, geographic location, population of the head of the household, Living Standard Measure (LSM), income quintile, dwelling type, metropolitan municipality, Households experiencing littering and households experiencing irregular or no waste removal.

3.7.1 Predictors of households receiving solid waste management services, using logistics regression

Table 3.4 shows that, nationally, households that lived in Western Cape were less likely to not have received solid waste management services than households in all provinces except North West and Gauteng. Households in Limpopo and Eastern Cape were respectively 1,1 and 0,76 times more likely to be without solid waste management services than those in Western Cape, while households in North West and Gauteng were respectively 93,3% and 66,3% less likely to not have access to solid waste management services. Households in rural areas were 3,7 times more likely to be without refuse removal services than those in urban areas. Households that lived in formal dwellings were, similarly, least likely to have been without solid waste management services. As could be expected, households in quintile 5 income category were the most likely to have had access to refuse removal services. This is confirmed by the LSM categories which show that households in LSM 1-4 were 2,1 times as likely as households in the top category to not have had access to solid waste removal services. Interestingly, households headed by coloured household heads with 1,2 times less likely than those headed by whites to have had access to refuse removal, probably because the coloured population is concentrated in urban, particularly metropolitan areas.

In urban areas, households in Free State and Gauteng were respectively 97,8% and 79% less likely than those in Western Cape to not have had access to solid waste removal services. Unfortunately, none of the other provincial estimates were significant at the 95% level of significance. It is also notable that urban households were much more likely than informal and traditional dwelling to have had access to refuse removal services. Households in the LSM 1-4 category were 2,7 times more likely, and those in LSM 4-7 about 1,03 times as likely than those in the highest LSM 8-10 category to have been without refuse removal services. As with the national finding, households headed by coloured household heads were less likely than those headed by their white counterparts to have been without refuse removal at home. In terms of households' perception of littering, those that reportedly experienced littering were 37,5% more likely than those who did not think littering was a problem to have been without kerbside refuse removal services.

Similar findings are observed in rural areas. Table 3.4 shows that rural in Western Cape were least likely to have been without kerbside solid waste management services. Households in Eastern Cape (3,3 times) and Limpopo (2,5 times) were particularly deprived in this respect, compared to Western Cape. Like the national and urban case, households in the wealthiest households (quintile 5 or LSM 8-10) were most likely to have had access to kerbside solid waste management services. Households in the poorest quintile were 1,15 times as likely as those in the wealthiest quintile to be without services, while households in the lowest LSM 1-4 category were 1,03 times more likely than those in the highest LSM category to be without refuse removal services.

Table 3.4 : Predictors of households receiving solid waste management services, using logistics regression, 2016

Probability modelled	Households receiving Solid waste management services		
	Urban	Rural	South Africa
Likelihood ratio chi-square	43 650	16 383	194 286
Hosmer and Lemeshow goodness of fit test (P-value)	0,0001	0,0001	0,0001
N	12 284	6684	18 968
Intercept	-4,045	-1,115	-4,051
AUC (model fit)	0,874	0,805	0,953
Maximum likelihood estimates			
Province	**Urban**	**Rural**	**South Africa**
Western Cape (reference category)			
Eastern Cape	0,3789*	3,3121	0,7616
Northern Cape	0,1492*	1,0261*	0,1101
Free State	-0,9775	1,8878	-0,5286*
KwaZulu-Natal	0,1394*	1,6225	0,2936*
North West	-0,3572*	0,3036*	-0,9328
Gauteng	-0,7898	0,3225*	-0,6631
Mpumalanga	0,1762*	1,5144	0,1984*
Limpopo	0,3345*	2,5701	1,0907
Geographical location			
Urban (reference category)			
Rural			3,7090
Dwelling type			
Formal (reference category)			
Traditional	2,3398	-0,0668*	1,0783
Informal	1,1747	-0,0689*	1,0495
Other	0,0699*	0,2084*	1,1606*
Income Quintile			
Wealthiest Quintile (reference category)			
Poorest quintile	0,0741*	1,1460	0,4947
Quintile 2	-0,0486*	1,2833	0,4967
Quintile 3	0,00959*	0,9579	0,3708
Quintile 4	-0,1025*	0,3666	0,1395*
Living Standard measure			
High (reference category)			
Low	2,6555	1,0252	2,0882
Medium	1,0341	0,2124*	0,7527
Population group of household head			
White (reference category)			
Black African	-0,0440*	-0,0378*	0,0766*
Coloured	-1,3668	-0,3908*	-1,2267
Indian / Asian	-1,0033*	-0,5875*	-0,9462*
Experience of littering			
Not Experiencing littering (reference category)			
experiencing littering	0,3751	-0,2620*	0,1632*
Experience of irregular or no waste removal			
Availability of waste removal services (reference category)			
No waste removal services	1,3608	0,8851	1,2438

*: Insignificant values at 95%.

3.7.2 Predictors of households not paying for solid waste management services, using logistics regression

Table 3.5 shows the relationship between binary variables (household willingness to pay for services, or to not pay) in urban and rural areas, as well as nationally and a set of predictor variables. The dependent variable is classified as follows: 1 = Paying for solid waste management services; 0 = Not paying for solid waste management services.

Table 3.5: Predictors of households living in formal dwellings not paying for solid waste management services, using logistics regression, 2016

Probability modelled	Households living in formal dwellings not paying for solid waste management services		
	Urban	Rural	South Africa
Likelihood ratio chi-square	67 545	7 868	78 600
Hosmer and Lemeshow goodness of fit test (P-value)	0,0001	0,0001	0,0001
N	9937	388	10 525
Intercept	3,1184	-0,3747	3,0643
AUC (model fit)	0,755	0,781	0,772
Maximum Likelihood Estimates			
Province	**Urban**	**Rural**	**South Africa**
Western Cape (reference category)			
Eastern Cape	-0,2933*	0,5518*	-0,2543*
Northern Cape	0,3320*	1,7378	0,3447
Free State	-0,6020	1,7796*	-0,5508
KwaZulu-Natal	0,0856*	1,3554	0,1119*
North West	-0,1947*	0,7223*	-0,2413*
Gauteng	-0,2277*	3,3385	-0,1522*
Mpumalanga	0,7211	2,7048	0,8084
Limpopo	0,1831*	2,3769	0,2984*
Geographical location			
Urban (reference category)			
Rural			-1,9216
Living Standard measure			
High (reference category)			
Low	-3,2517	-1,8297	-3,1469
Medium	-1,7602	-0,8897	-1,7132
Population group of household head			
White (reference category)			
Black African	-1,2064	-2,2060	-1,2494
Coloured	-0,3850	-0,0531*	-0,3966
Indian / Asian	-0,3694*	-14,8521	-0,4137*
Metropolitan Area			
Living in metropolitan municipality			
Living in non-metropolitan municipality (reference category)	-0,0373*		-0,0290*

*: Insignificant values at 95%.

Nationally, Table 3.5 shows that households in Mpumalanga and Northern Cape were respectively 80,8% and 34,5% more likely than those in Western Cape to have paid for solid waste management services, while those in Free State were less likely to have paid. It is notable that households in rural areas were 1,9 times less likely than those in urban areas to have paid for services. The model also reveals a positive relationship between the likelihood of paying for

services and the household socio-economic condition. While the wealthiest households (those in LSM 8-10) were the most likely to have paid for services, households in LSM 5-7 and LSM 1-4 were respectively 1,7 and 3,1 times less likely to have paid for waste removal services. Similarly, both the coloured (-39,7%) and black African (-125%) headed households were less likely than white-headed households to have paid.

In urban areas, the model shows that Free State households were less likely to have paid, while household in Mpumalanga were 72% more likely than those in Western Cape to have done so. The same pattern is revealed with regards to households income and population group of the household head, namely that the wealthiest households, and those headed by white heads were most likely to have paid, while the poorest households, and those headed by black African heads were least likely to have paid.

An interesting picture emerges with regards to rural areas across geographical space. Table 3.5 namely shows that rural households in Western Cape were least likely to have paid for waste removal services. The model, however, reiterates the findings of the rural and national models with regards to the effect of the living standards measure and population group in so far as households in the highest LSM category (LSM 8-10) and those headed by white heads were most likely to have paid.

3.8 Summary and Conclusions

National Treasury (2011) states that, solid waste management services are critical to maintain environmental sustainability by protecting water courses, ground water, and preventing illegal dumping and littering. This study investigated solid waste practices, waste disposal, and perceptions about waste across a large representative sample of South African households using the General Household survey 2016. Levels of solid waste management services provision has improved by about eight per cent in South Africa between 2002 and 2016 whilst a decline by similar margin was witnessed for households who dump or leave rubbish anywhere or those using own refuse dump.

Although progress was made, huge provincial and geographical disparities remains. The provision of solid waste management services was greater for households living in more affluent provinces than their counterpart in the underprivileged provinces. Improvements in the provision of solid waste management services between 2002 and 2016 were recorded in all the provinces but KwaZulu-Natal with insignificant decline. Generally coverage was superior for households living in metropolitan municipalities with an exception of Buffalo City. Despite a national decline of about eight per cent for households who dump rubbish anywhere or use own refuse dump, a large percentage of rural households still relied on these services. Provision of solid waste management services is a function of income as households in the wealthiest quintile and those in LSM 8-10 were most likely to receive such service. The analysis of Community Survey 2016 show that households living in Metropolitan Municipalities were receiving solid waste management services whilst households in rural municipalities relied on central collection points. District analysis shows that solid waste management services were most common in districts around Gauteng, Western Cape, the Western seaboard, and eThekwini. Households living in the largely rural district municipalities of the Eastern Cape, Limpopo, some parts of KwaZulu-Natal and North West reported poor access to waste management services and a much higher percentage of households also rated services as ‘poor’.

The nature of the services that local governments can provide is impacted by amongst others by affordability and municipal capacity hence households' ability and willingness to pay for services is vital. Due to the challenge that rural households and households living in informal dwellings face in terms of payment of services, the analysis was restricted to households that received solid waste management services. Households that lived in formal dwellings in rural provinces were least likely to pay for solid waste management services received, but were also least likely to be willing to have paid for such services. Generally, households that lived in Metropolitan municipalities were most willing to pay for services. Unfortunately the reasons for non-payment was not asked in the GHS. Although a large percentage of rural. Low LSM households headed by black Africans were not paying for solid waste management received, many of these households indicated a large willingness to pay for such services.

Despite the availability of some information of solid waste management form surveys like the GHS and the CS, comprehensive data at local municipal level is still relatively scarce and irregular. This is particularly a challenge in rural municipalities, or even district municipalities, where supporting infrastructure are usually absent. The aim of obtaining more information should be improved collaboration and integration between research institutes, government agencies and departments, and municipalities. Part of this effort should involve moving away from merely using survey data, to embracing administrative data held and maintained by other stakeholders in an open environment of collaboration. Future studies also need to be prospective by asking questions that would allow measurement a variety of waste categories, including the surge of electronic waste experienced today.

4 Recycling

4.1 Introduction

Rapid growth in the volume of solid waste generated in the wake of increasing industrialisation and urban development creates a serious environmental challenge. Lifestyle changes encourage an increased demand for discarded goods and packaging. Urban households therefore generate much more waste than rural ones, and the share of packaging of the waste stream is continuously increasing (UN-Habitat, 2010). The Department of Environmental Affairs (2012) reports that 90% of an estimated 59 million tonnes of general waste produced in South Africa in 2011 ended up in landfills, while only 10% was recycled. The rapid growth in solid waste is leading to a continued shortage of suitable land to dispose of waste. The limited availability of suitable land and the high cost of establishing landfills, however, reemphasise the need for alternative waste management options. This position is reinforced by the fact that landfills contribute significantly to the increased emanation of methane gas, and therefore global warming.

Although most waste is created by the commercial and industrial sectors, waste produced by households is substantial, and expected to grow. The recycling of household waste is therefore considered a key process to address environmental challenges.

Despite the obvious benefits of, and need for recycling, studies report that as little as 5,2% of households recycled waste in 2015 (Strydom & Godfrey, 2016); up marginally from 3,3% of households in 2010 (Oelofse, 2012). These low levels of participation require closer scrutiny and this section intends to examine why households adopt and maintain recycling behaviour in relation to the influence of their socio-economic context and environmental perceptions.

4.2 Objectives

This section will measure the prevalence of recycling in South Africa using data from the General Household Survey; study the effect of socio-economic factors such as population group, socio-economic status and contextual factors on urban recycling behaviour; and finally, establish the impact of environmental perceptions on recycling behaviour.

This section uses data from GHS 2015 as that is the last year that a comprehensive set of questions on recycling was asked. Analysis is largely restricted to urban households as recycling largely associated with presence of organised solid waste removal and recycling centres which are not available in households located in rural areas or on farms.

4.3 South African context

The National Environmental Management Act (NEMA) (RSA, 1998) states that "...waste is to be avoided, or where it cannot be altogether avoided, minimised and reused or recycled where possible or otherwise disposed of in a responsible manner". Taking this lead, the National Waste Management Strategy (NWMS) (DEA, 2011) had set goals to divert 25% of recyclables from landfill sites for re-use, recycling or recovery; and for all metropolitan municipalities, secondary cities and large towns to have initiated separation at source programmes by 2016. The NWMS had also

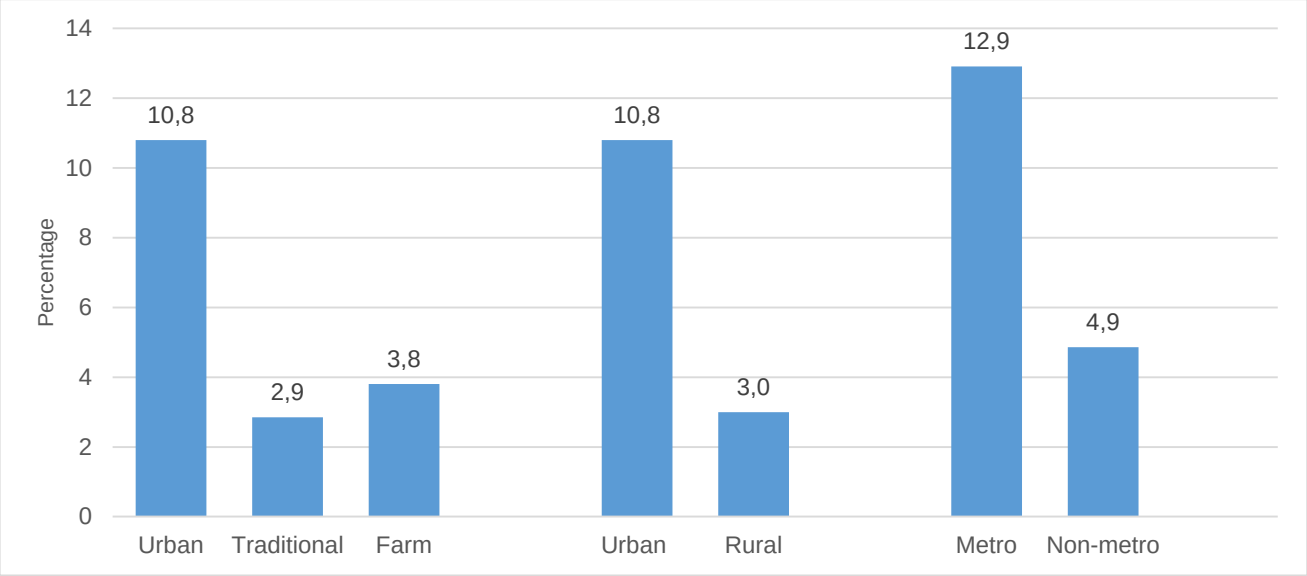
set a goal that 80% of municipalities should have been running local awareness programmes by 2016. The recycling of waste presents an opportunity to save resources while reducing the environmental impact of waste disposals. Recycling, however, remains inadequate. According to a baseline study conducted by the DEA (2012) only 10% of an estimated 95 million tonnes of general waste generated in 2011 was recycled. Given the low participation rate of households, it is clear that the informal sector plays a vital role in diverting material from landfills.

The implementation of the Waste Act (Republic of South Africa, 2008) requires that waste is separated at household level, and that municipality's municipal waste collection services support new waste collection practices. Household participation and attitudes are therefore vital to the successful implementation of the Waste Act. Although more than 80% of municipalities had already initiated some kind of recycling programme by 2007 (DEAT, 2007), the original observation that municipalities struggled with implementation due to a lack of capacity or infrastructure, still seems to hold true.

4.4 Household recycling in South Africa

The nature and prevalence of recycling is to a large extent determined by, inter alia, the kind and availability of recyclable materials, population density, the availability of buy-back centres, and the ability of municipalities to provide adequate refuse removal services. The recycling behaviour of households can therefore be expected to vary across geographic locations that exhibit different characteristics.

Figure 4.1: Percentage of households that sorted refuse for recycling purposes by geotype, 2015



The percentage of households which reported that they separated material for recycling is presented in Figure 4.1. The figure shows that self-reported recycling was most common in metropolitan households (12,9%), followed by household across urban areas in general (10,8%) and households in rural areas (3%). Of the rural households, recycling was more common amongst households on farms (3,8%) than households in traditional areas (2,9%).

The rest of the analysis is restricted to urban households since the absence of formal refuse removal services and recycling centres in rural areas make it very difficult to study recycling in these areas.

Figure 4.2: Percentage of urban households that sorted refuse for recycling purposes by province, 2015

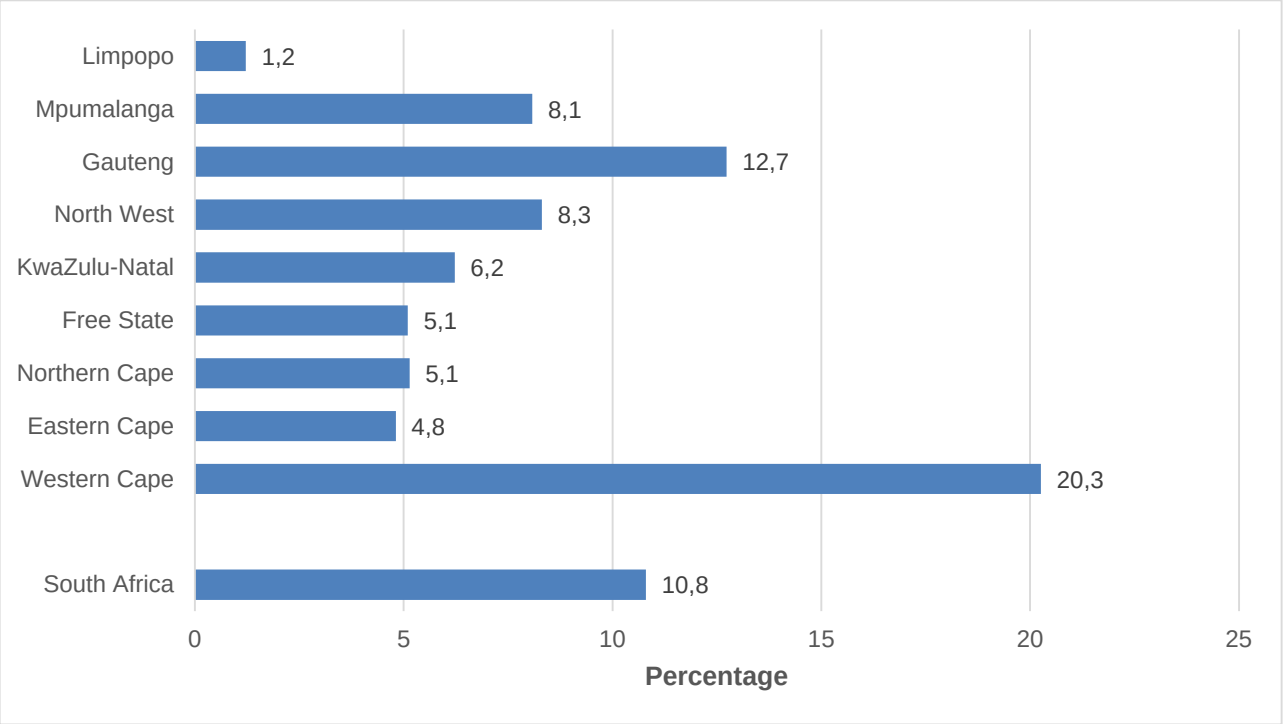
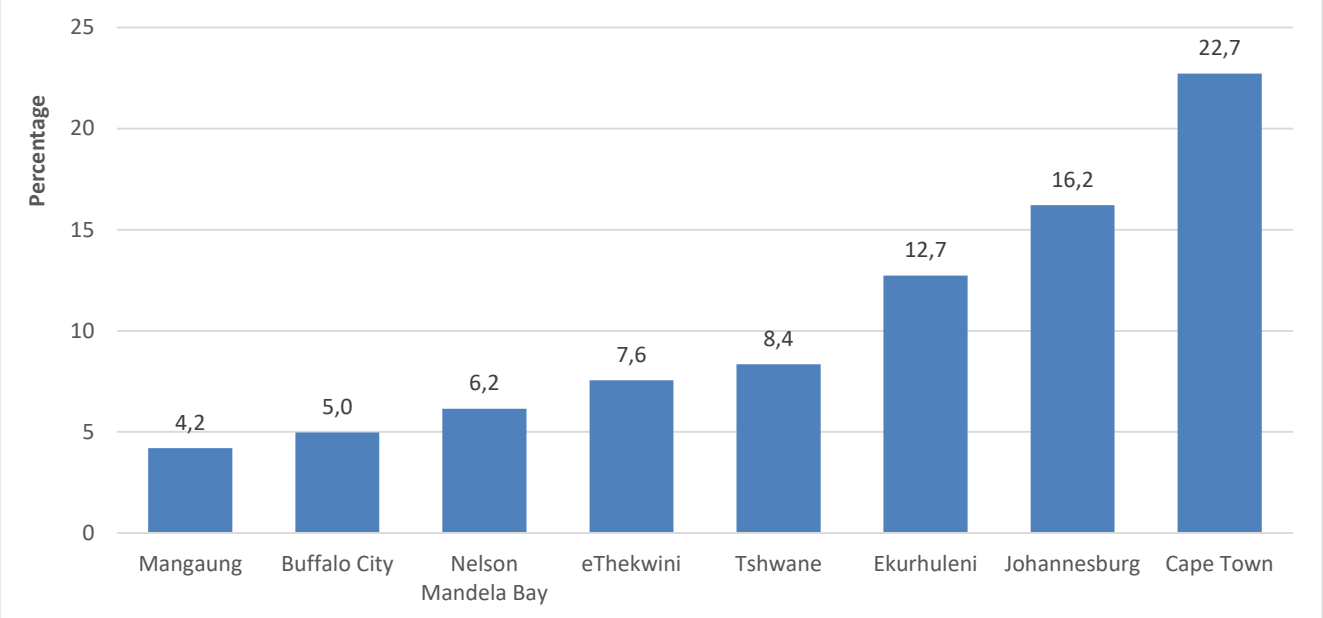


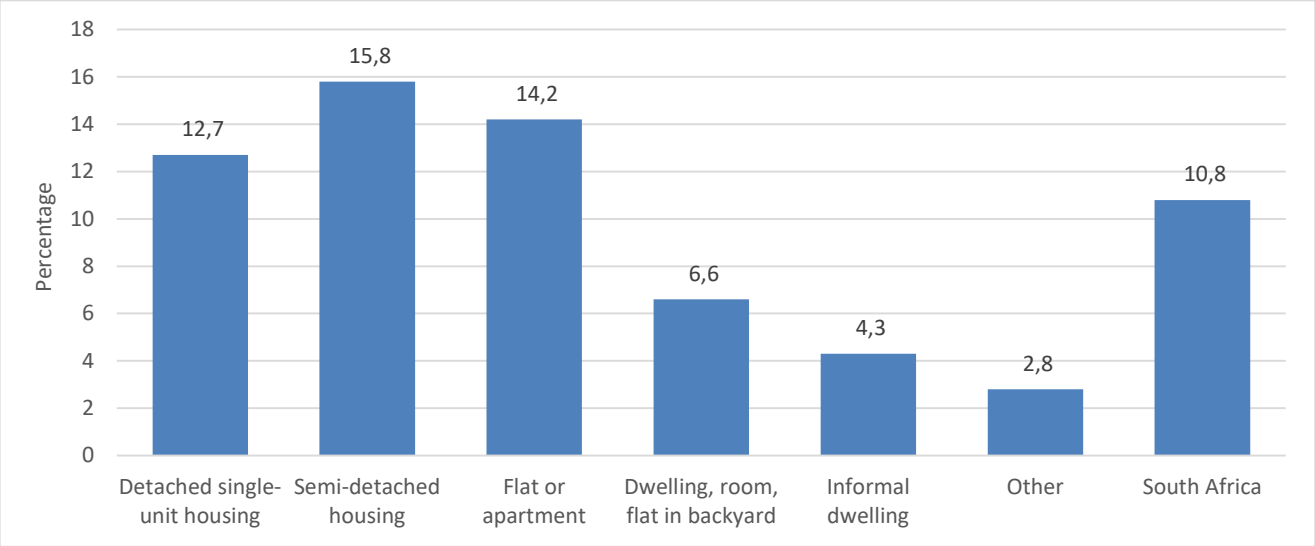
Figure 4.2 shows that waste recycling was most common in provinces with the largest urban populations and least common in the most rural provinces. While 20,3% of urban households in Western Cape, and 12,7% of urban households in Gauteng sorted waste for recycling, only 1,2% of urban households in Limpopo recycled waste. A similar pattern emerges when household recycling across the eight metropolitan municipalities is compared.

Figure 4.3: Percentage of urban households that sorted refuse for recycling purposes by metropolitan municipality, 2015



Although household recycling was much more common in metropolitan areas than urban areas as a whole, large variations are observed in Figure 4.3. While 22,7%, 16,2% and 12,7% of households in respectively Cape Town, Johannesburg and Ekurhuleni reportedly sorted waste for recycling, the uptake of recycling was estimated at 4,2% in Mangaung, 5% in Buffalo City and 6,2% in Nelson Mandela Bay.

Figure 4.4: Percentage of urban households that sorted refuse for recycling by type of dwelling, 2015



To recycle household waste, at least one household member needs to collect, sort, store and dispose of waste materials by putting it out to be collected or by transporting it to recycling centres (Anderson, Romani, Wentzel and Phillips, 2013). Space is, however, required to sort and store household waste until it could be collected or disposed of. The unique physical features of various dwelling types therefore raises questions about the relative impact of various social and physical effects on recycling behaviour. Referring to townhouses, Du Toit, Wagner and Fletcher (2015) hypothesized that recycling could be hampered by smaller kitchens and backyards, the lack of communal recycling facilities, and the restricted access to complexes.

Figure 4.4 shows that, against expectations, recycling was more prevalent amongst households that lived in semi-detached dwellings (15,8%) and flats or apartments (14,2%) than in detached single-unit houses (12,7%). Recycling behaviour was, however, much lower in informal dwellings (4,3%) and backyard structures (6,6%), raising the question whether the decision to recycle is only informed by space considerations.

4.5 Characteristics of the household head

This section explores the role of population group and other socio-economic factors on the recycling behaviour of urban households in South Africa. Due to the persistent consequences of apartheid and colonialism, different population groups still largely exhibit different levels of development. Since white and Indian/Asian households are far more likely to live in urban areas and to have access to basic household amenities than their coloured and black African counterparts, different recycling behaviours should not come as a surprise.

Figure 4.5: Percentage of urban households that sorted refuse for recycling by population group of the household head, 2015

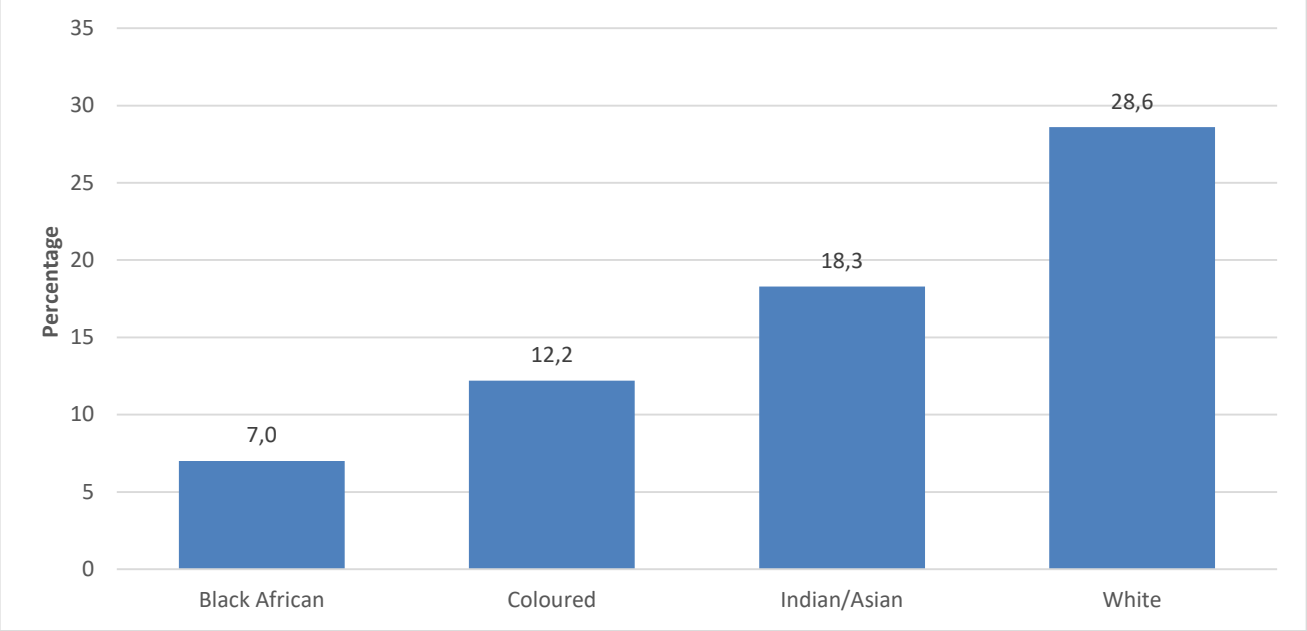
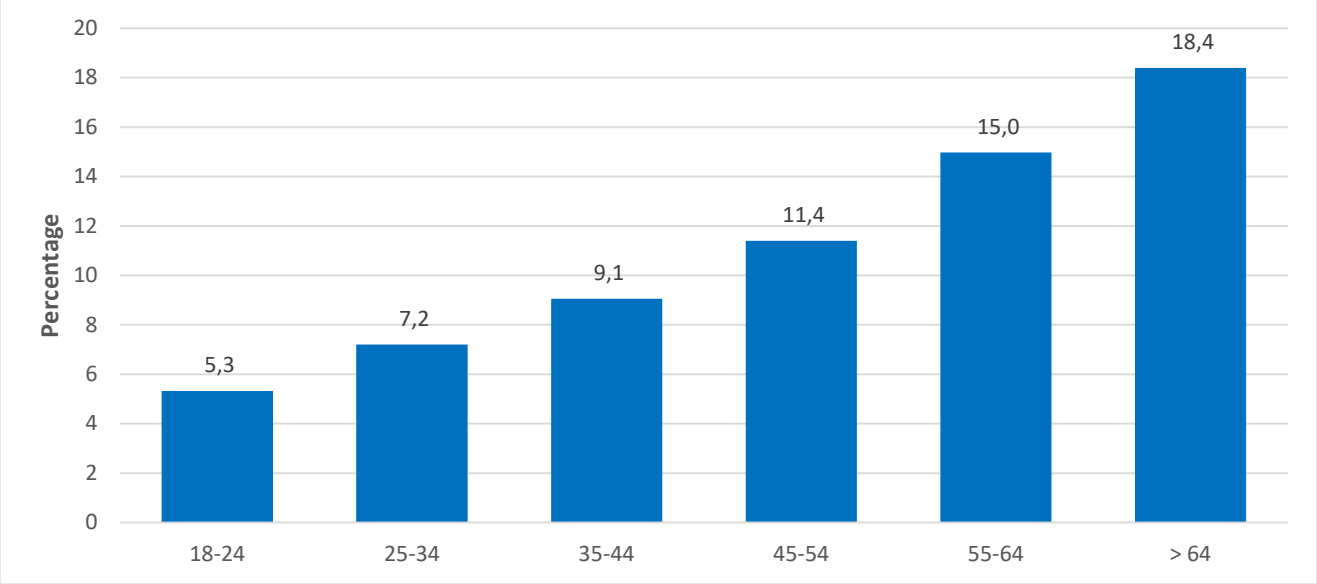


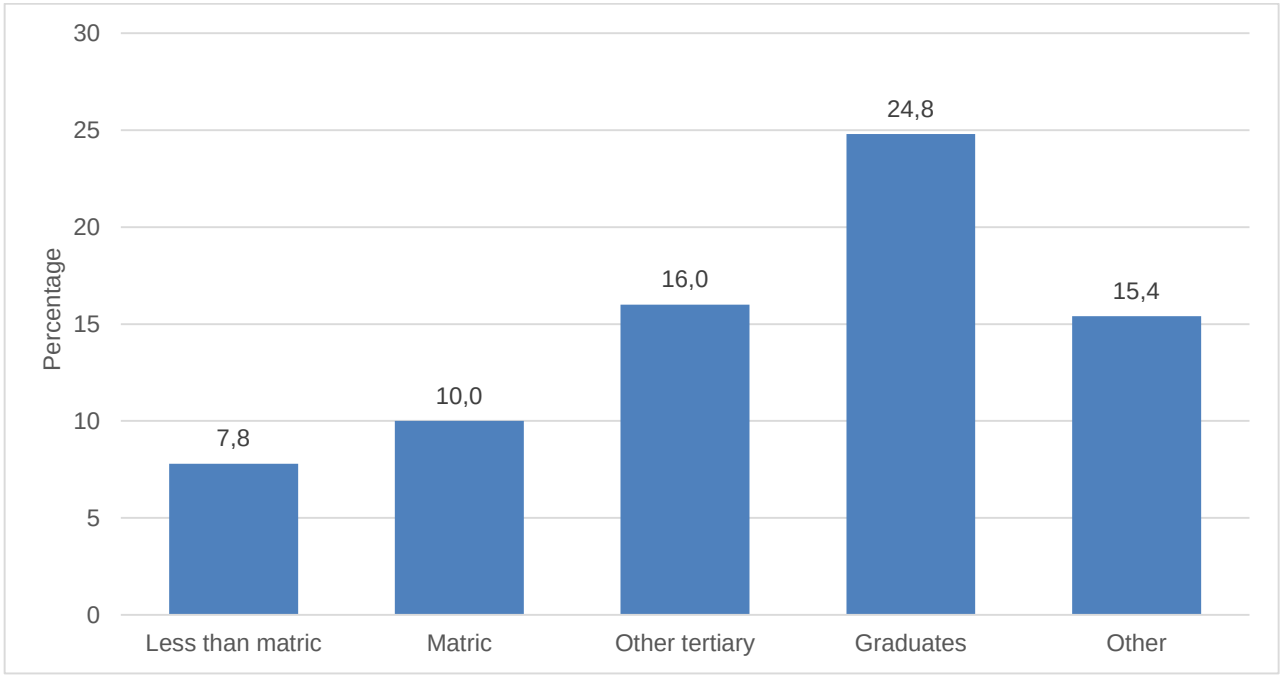
Figure 4.5 shows that waste recycling was most common amongst households headed by whites (28,6%), and least common amongst households headed by black Africans (7,0%).

Figure 4.6: Percentage of urban households that sorted refuse for recycling by age group of the household head, 2015



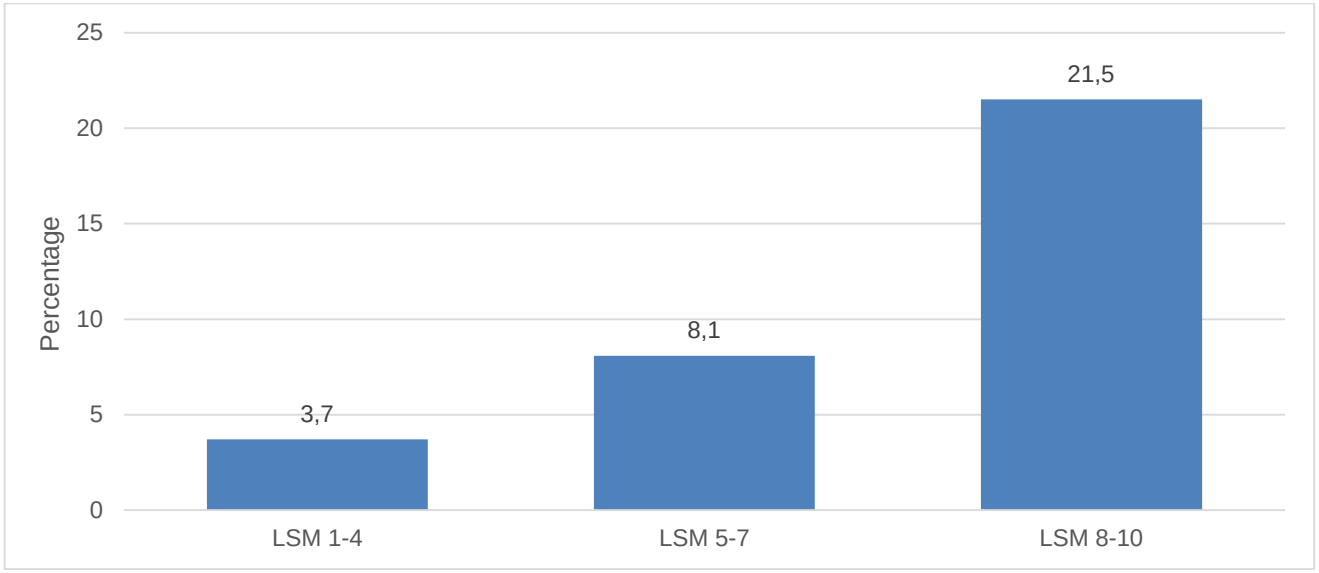
The prevalence of household recycling behaviour was lowest for households headed by young adults aged 18-24 years of age (5,3%), and consistently increased for each following age group. Figure 4.6 shows that recycling was most common amongst households headed by heads aged 65 years of older. In the latter category, almost one in five households sorted waste for recycling. This figure supports the finding of a US and UK surveys (Boteler, 2017) which showed that millennials (16-34 year olds) were least like to recycle, while the oldest age groups were most likely to do so.

Figure 4.7: Percentage of urban households that sorted refuse for recycling by the household head's highest level of education, 2015



Improved levels of education may increase households' knowledge and awareness of environmental risks, and motivate households to improve the management of solid waste, including the need to recycle. Although the questionnaire, unfortunately, did not examine householders' level of environmental awareness, education has been shown to improve the ability to understand complex problems and to develop generalized views on the importance of the environment. Figure 4.7 shows that recycling was most common amongst households headed by individuals who attained a degree, while recycling was least common amongst households with heads who have not completed matric or grade 12. These patterns are almost certainly related to levels of household income.

Figure 4.8: Percentage of urban households that sorted refuse for recycling by broad LSM category, 2015



Using LSM scores to classify standards of living, recycling was most common for households in the highest LSM category, and much less common for poorer households. The findings in Figure 4.8 corroborate other findings (Kamara, 2006; Xiao and Dunlap, 2007; Shen and Saijo, 2008) which found a strong association between income and environmental awareness. Poorer households are often primarily concerned with survival and therefore less inclined to recycle, while structural factors such as access to proper refuse removal services or access to buy-back centres may also limit the opportunities to recycle.

4.6 Recycling and refuse removal

In South Africa, solid waste management services are usually limited to the core of towns and cities, surrounding suburbs and to a few township areas. Few, if any, services are available in informal areas and outlying peripheries. Households that receive solid waste management services are more likely to sort waste for recycling since sorted items could be stored on site while un-recycled items could be removed on a regular basis. By contrast, households whose refuse is not collected were much less likely to participate in any recycling activities.

Figure 4.9: Percentage of urban households that sorted refuse for recycling by type of solid waste removal 2015

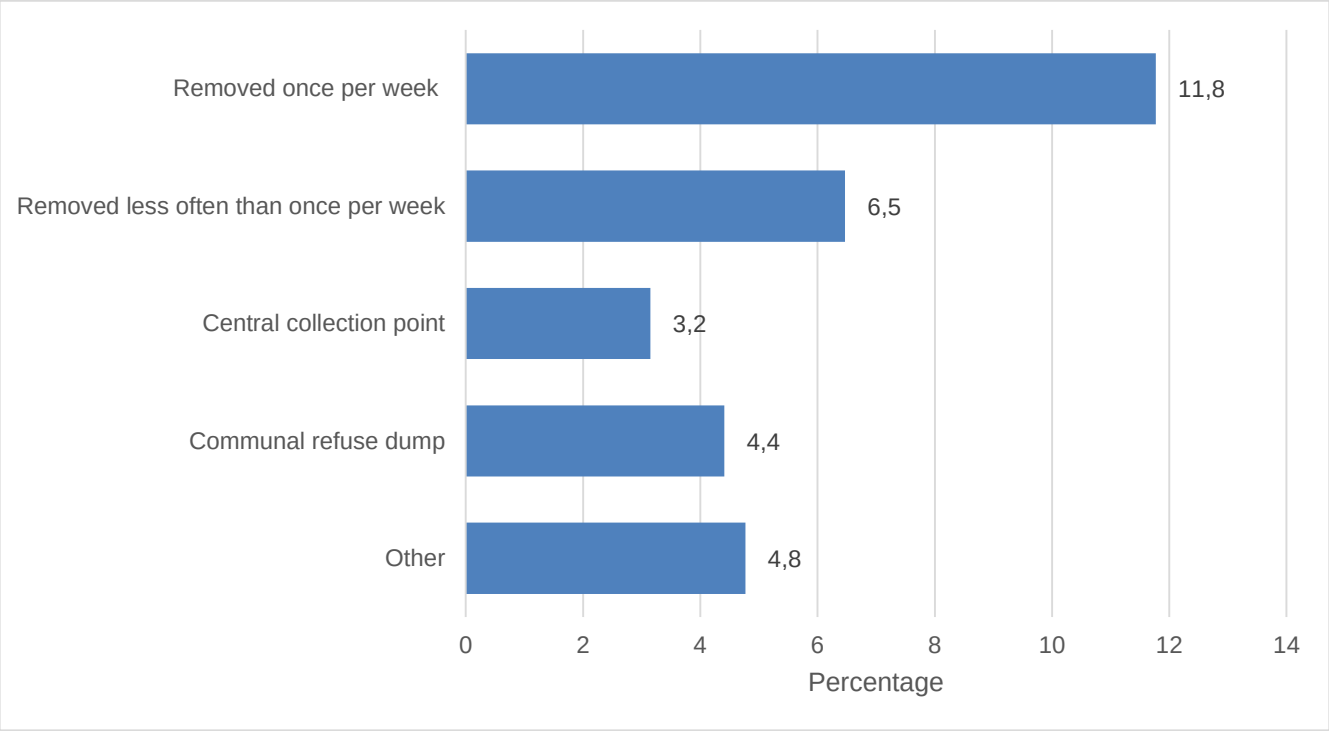
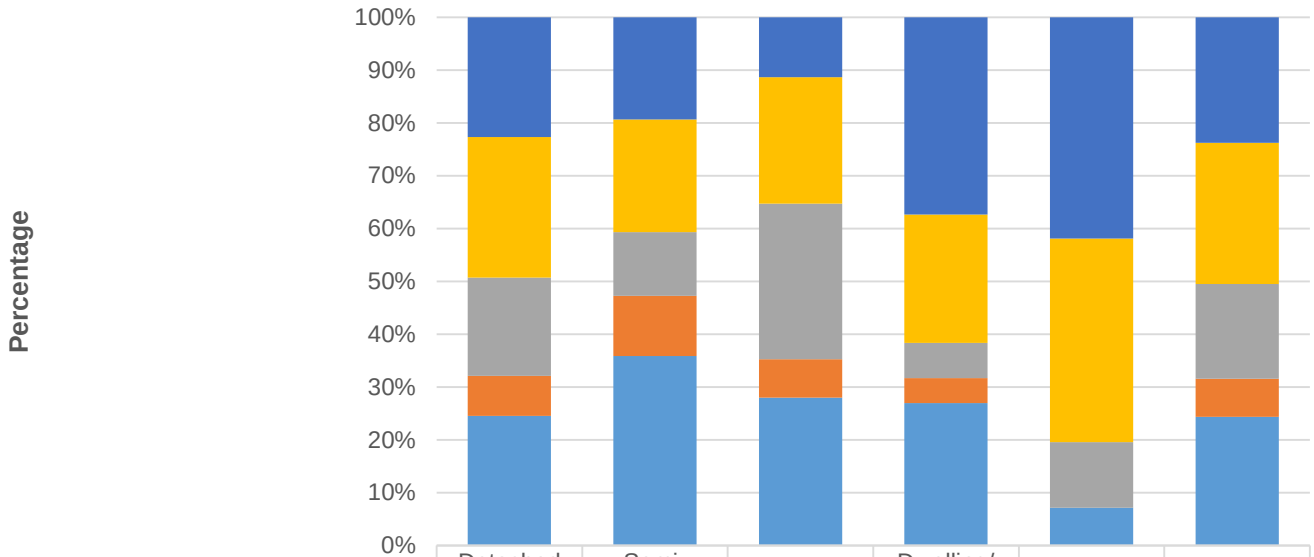


Figure 4.9 shows that recycling activities were, indeed, more common amongst households whose refuse was collected at least once per week, followed by households whose waste were collected less regularly. Although some households who depend on communal refuse dumps or central collection points also indicated that they recycle material, this observation should be treated with circumspect as the sorting of material could refer to a limited number of items (e.g. only glass or metal) and an undetermined frequency. These results could, however, also be skewed slightly by the fact that some middle-income housing complexes also use a form of central collection which could include recycling at source.

4.7 Collection and disposal of recycled materials

Although metropolitan municipalities, secondary cities and large towns should have initiated separation at source programmes by 2016 according to the National Waste Management Strategy (NWMS) (DEA, 2011), limited resources and poor administration have prevented any large-scale roll-out of recycling programmes. The lack of programmes to sort waste at the source is encouraging salvaging by informal waste pickers at the source, or at land fill sites. Households that want to recycle their waste often has to resort to using private companies (such as the Waste group), or they have to transport waste to recycling centres themselves.

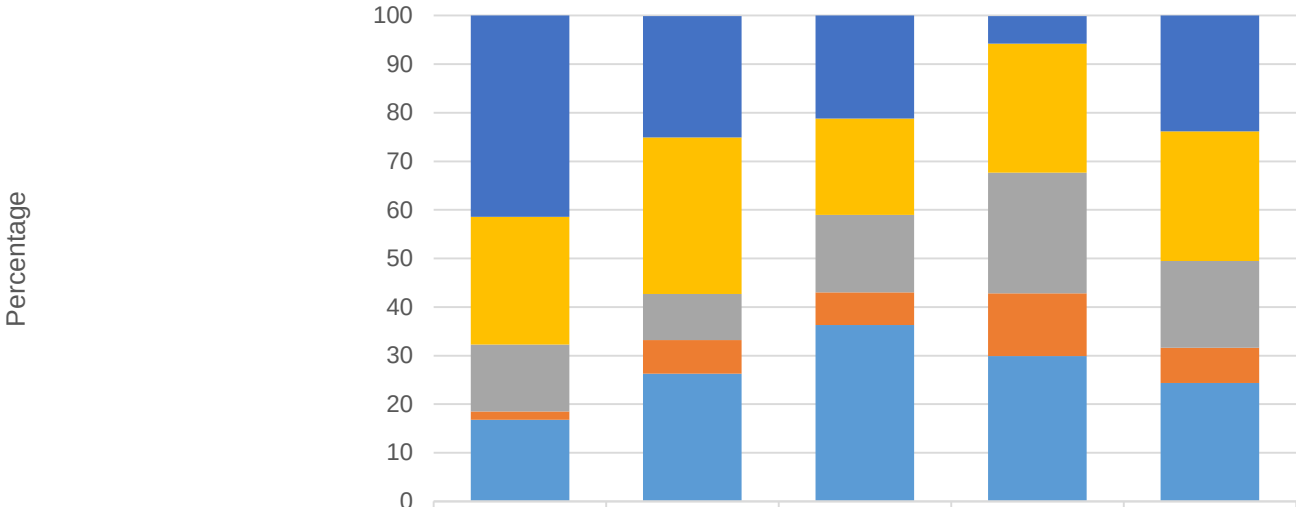
Figure 4.10: Mode of sorted waste removal by dwelling type, 2015



	Detached single-unit housing	Semi-detached dwellings	Flats/Apartments	Dwelling/ room in backyard	Informal dwelling	Total
Other	22,7	19,3	11,4	37,3	41,9	23,8
Taken to drop off point by household	26,6	21,3	23,9	24,3	38,5	26,7
Fetched by private companies	18,6	12,1	29,4	6,7	12,4	17,9
Fetched by contracted companies	7,6	11,4	7,3	4,7	0,0	7,2
Fetched by municipality	24,6	35,9	28,0	27,0	7,2	24,4

The method used to remove waste sorted out for recycling by urban households is presented in Figure 4.10. Overall, the figure shows that approximately one-quarter (26,7%) of all households took their waste to drop-off points, while waste was fetched by the municipality for another 24,4%. Notably, 23,8% of households used 'other' methods. Although households were not asked to elaborate what these mean, it probably refers to informal waste pickers who fetch household waste to sell to buy-back centres. The use of drop-off points and 'other' means were most common for households that lived in informal dwellings (41,9% and 38,5%). Similarly, 37,3% of households that lived in backyard dwellings used 'other' means. The use of private companies were most common for households that lived in flats or apartments. More than one-third (35,9%) of households that lived in semi-detached dwellings indicated that their separated waste was fetched by the municipality.

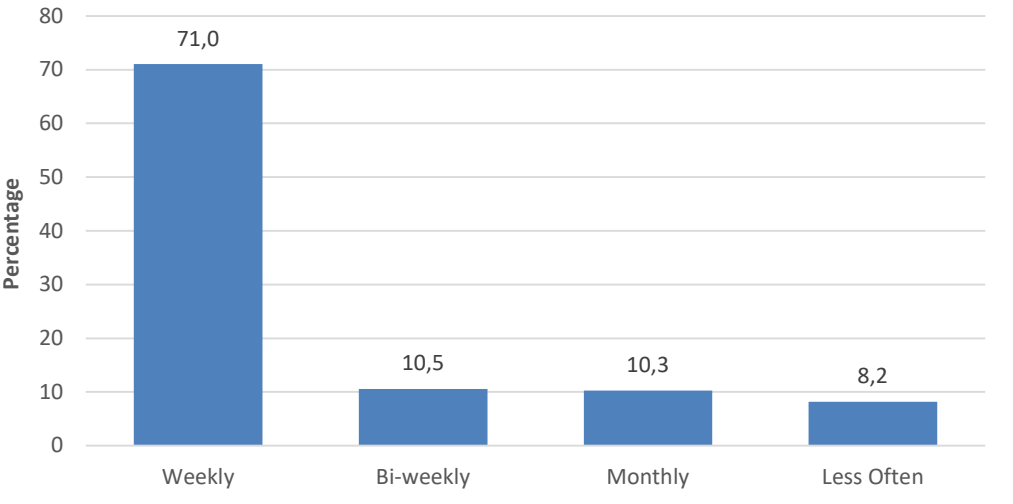
Figure 4.11: Mode of sorted waste removal by population group of the household head, 2015



	Black African	Coloured	Indian / Asian	White	Total
Other	41,5	25,0	21,3	5,7	23,8
Taken to drop off point by household	26,3	32,2	19,8	26,5	26,7
Fetched by private companies	13,8	9,5	16,0	24,9	17,9
Fetched by contracted companies	1,7	6,9	6,7	12,9	7,2
Fetched by municipality	16,8	26,3	36,3	29,9	24,4

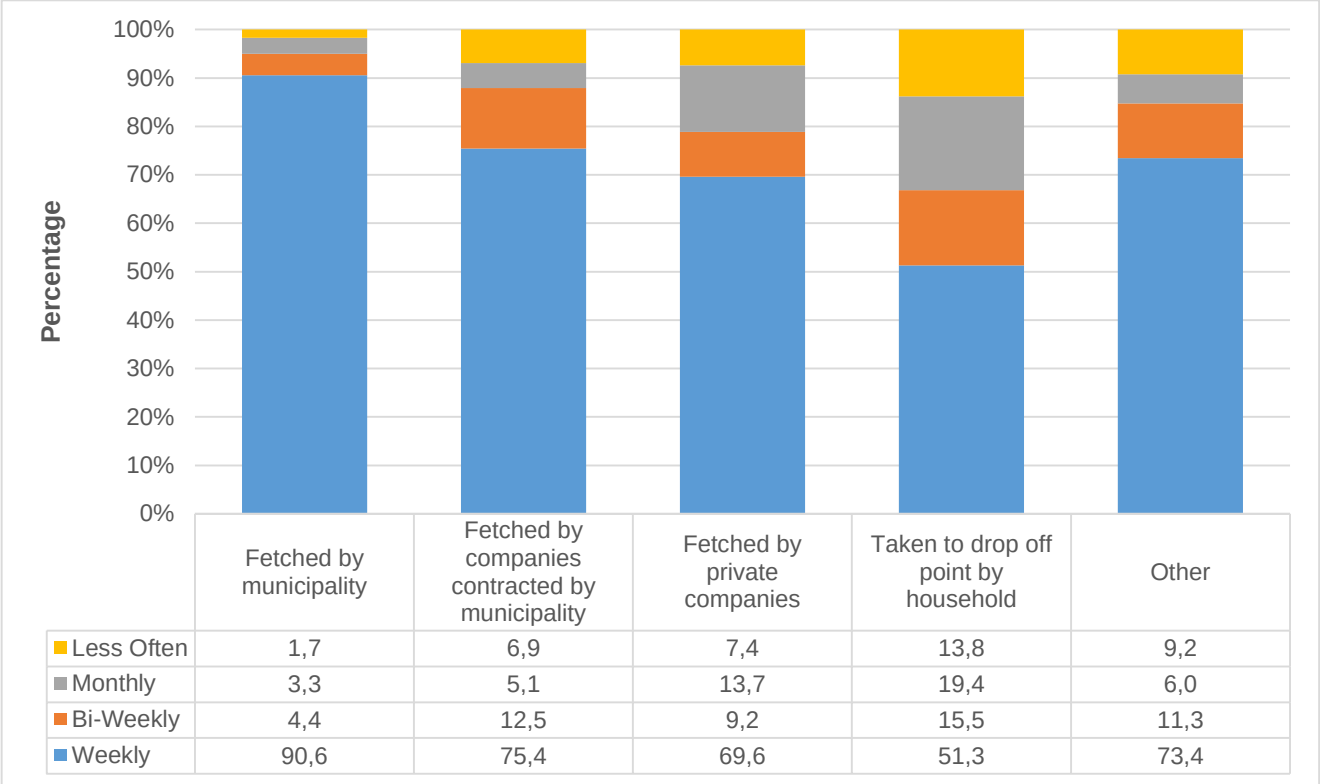
Figure 4.11 shows that four-tenths (41,5%) of black African-headed households used 'other' means (probably informal waste pickers) to remove sorted waste, while 26,3% took waste to a drop-off point. The use of drop-off points was most common for coloured-headed households (32,2%) and least common for Indian/Asian-headed households. The use of private companies was most common for white-headed households (24,9%).

Figure 4.12: Frequency at which separated household waste is fetched or removed in urban areas, 2015



More than seven-tenths (71,0%) of household that sorted waste for recycling indicated that waste was removed or disposed of on a weekly basis. A further 10,5% reported that removal or disposal took place on a bi-weekly basis.

Figure 4.13: Recycling mode preferred by households in urban areas, 2015



	Fetched by municipality	Fetched by companies contracted by municipality	Fetched by private companies	Taken to drop off point by household	Other
Less Often	1,7	6,9	7,4	13,8	9,2
Monthly	3,3	5,1	13,7	19,4	6,0
Bi-Weekly	4,4	12,5	9,2	15,5	11,3
Weekly	90,6	75,4	69,6	51,3	73,4

More than 90% of recycling households whose sorted waste was fetched by the municipality indicated that it took place on a weekly basis. The percentage of households whose sorted waste was removed on a weekly basis declined to 75,4% for waste removed by companies that were contracted by the municipality, 69,6% for private companies, and 51,3% for cases where waste is disposed of at drop-off points. It is notable that households who took waste to drop off points did so much less regularly, meaning that they had to have a place to store waste in the interim.

Figure 4.14: Percentage of urban household that separated waste for recycling by the type of container used to store waste before disposal, 2015

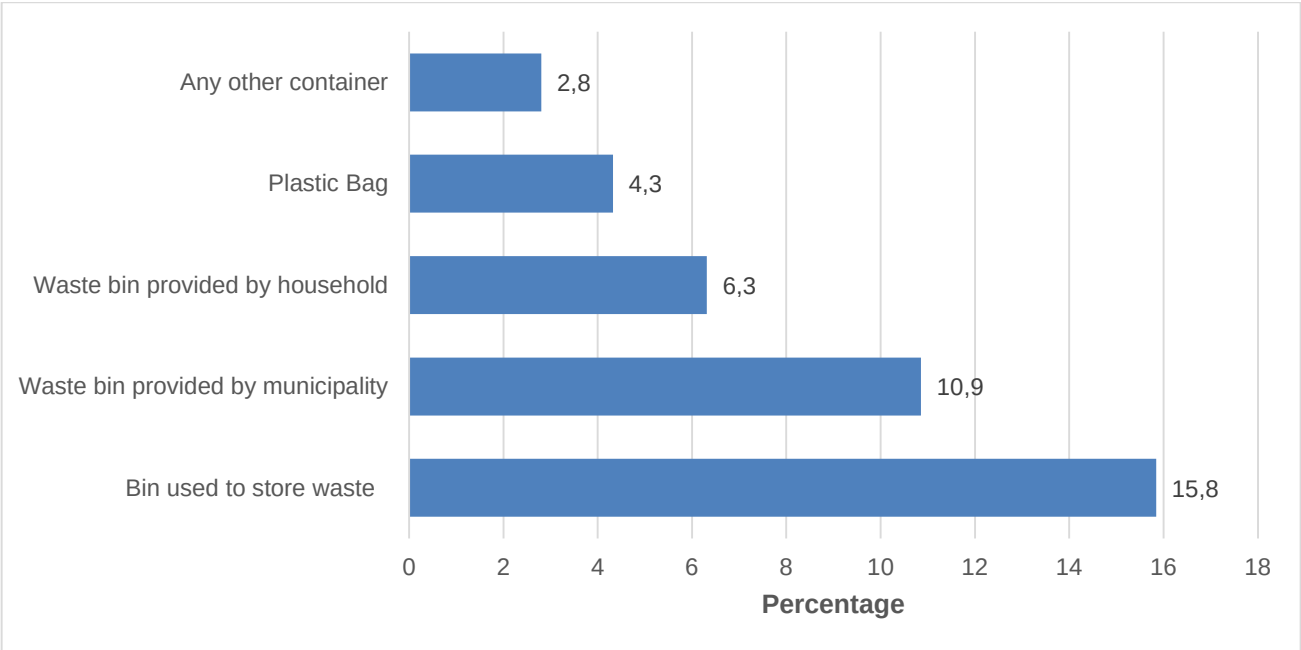
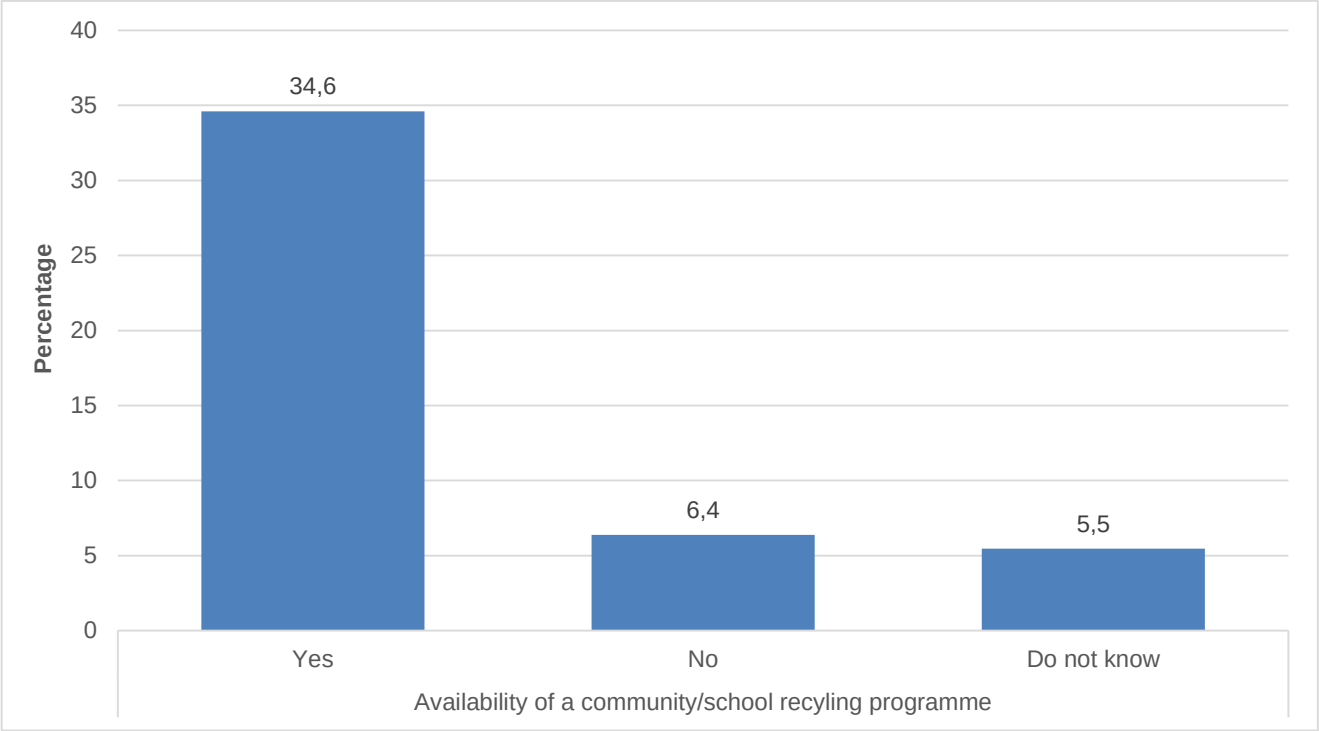


Figure 4.14 presents household's differential rates of participation in recycling according to the type of container used to store waste before disposal. The figure shows that 15,8% of households that used bins also separated waste for recycling, while 10,9% of households that used municipal bins recycled waste. Only 4,3% of households (less than the national average) that used plastic bags to store waste before disposal participated in recycling. The data suggest that the provision of waste bins to store separated waste, as well as enough buy-back and drop-off centres are vital.

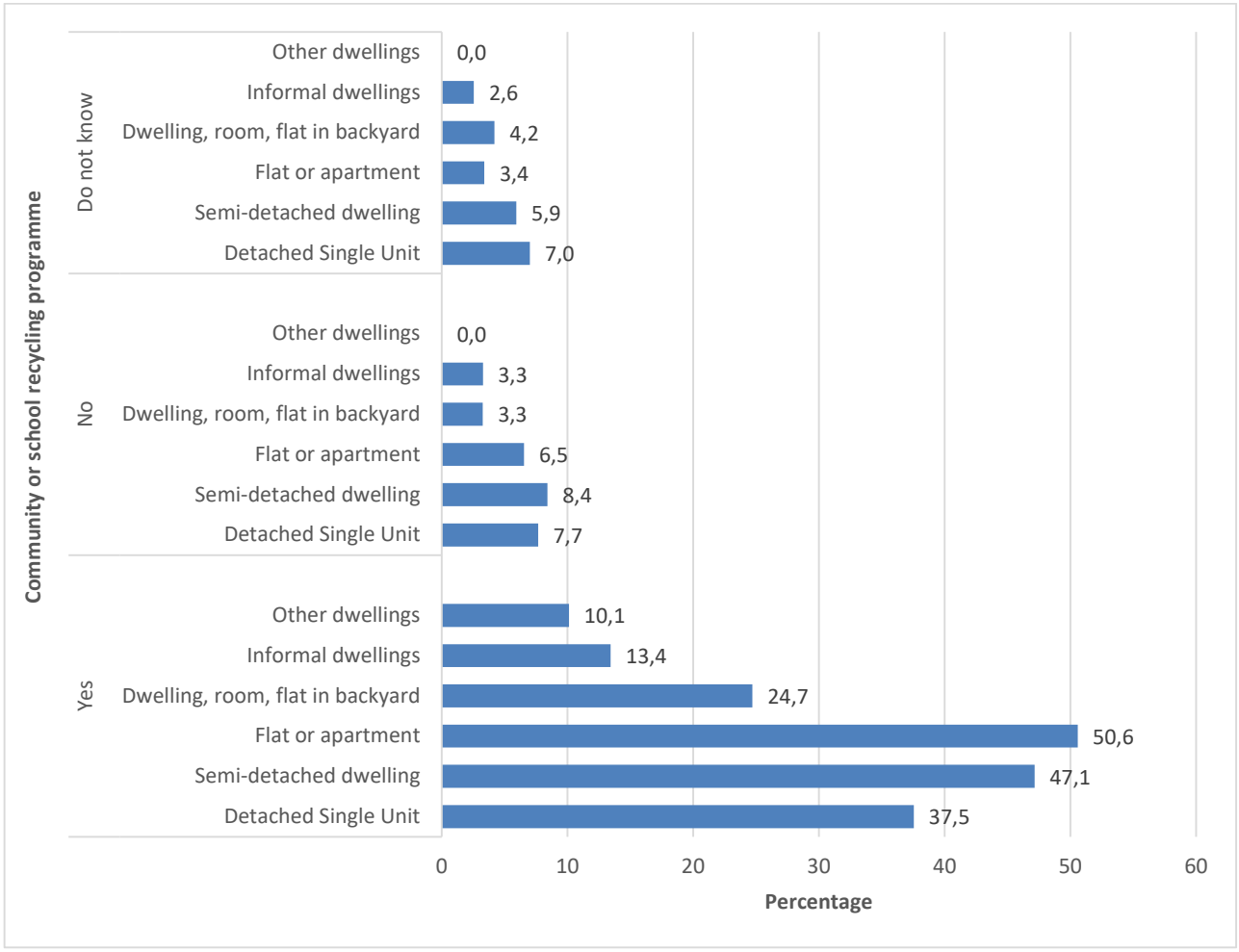
Figure 4.15: Percentage of urban households that sorted refuse for recycling by the availability of a community/school recycling programme, 2015



Of the households that sorted waste for recycling, more than one-third (34,6%) indicated that they knew about a community/school recycling programme. Figure 4.15 shows that only 6,4% of recycling households did not know of such a programme in the neighbourhood or community. The relationship between awareness of local buy-back or drop-off centres and household participation in recycling is even more pronounced when considered in terms of the type of dwellings that are inhabited by households.

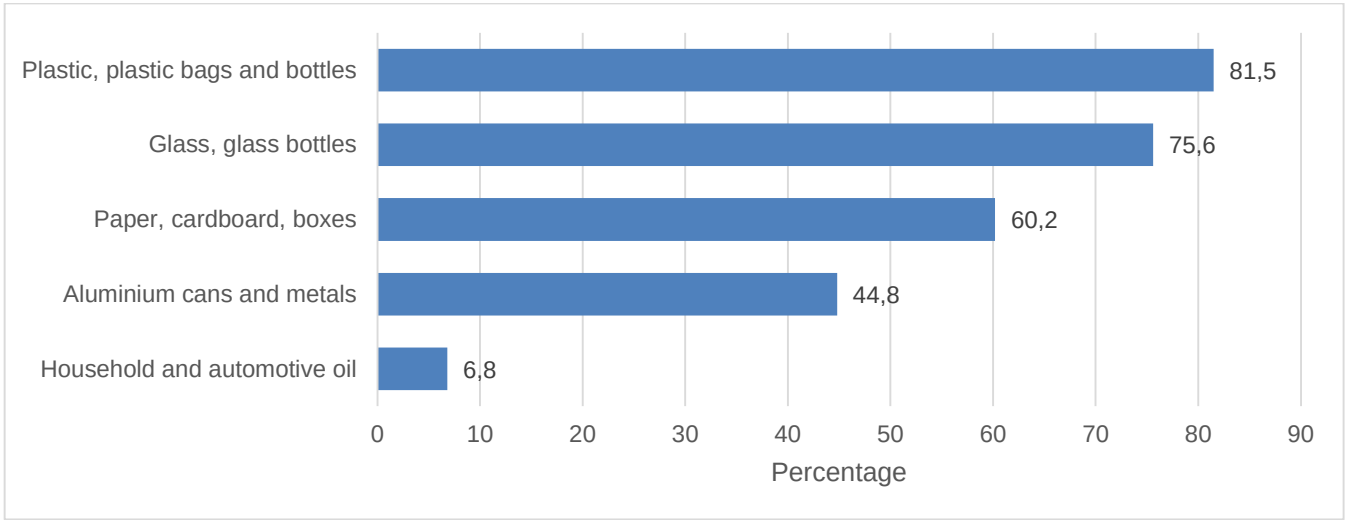
Figure 4.16 shows that recycling behaviour is most common for households that know of community or neighbourhood recycling programmes across all types of dwellings. Of the households that knew of community or school recycling programmes, recycling was most common for those that lived in flats or apartments (50,6%), semi-detached dwellings (47,1%) or detached single units (37,5%). Recycling was much less common among households, across all dwelling types, who said that there were no community or school recycling programmes near them, or who did not know. The availability and/or knowledge of appropriate drop-off or buy-back centres seems to be positively related to household recycling behaviour.

Figure 4.16: Percentage of urban households that sorted refuse for recycling by the availability of community/school recycling programmes and dwelling types, 2015



Afrika, Oelofse, Strydom, Mvuma and John (2016) mention that the lack of separation of waste at the source could have a number of far-reaching implications. Besides encouraging salvaging at landfill sites, a lack of separation will also lead to mingling of low and high-value waste products that could potentially lead to a lower yield and/or damage to viable waste products, such as when paper or carton products are invariably mixed with oil-based products.

Figure 4.17: Items recycled by households in urban areas, 2015

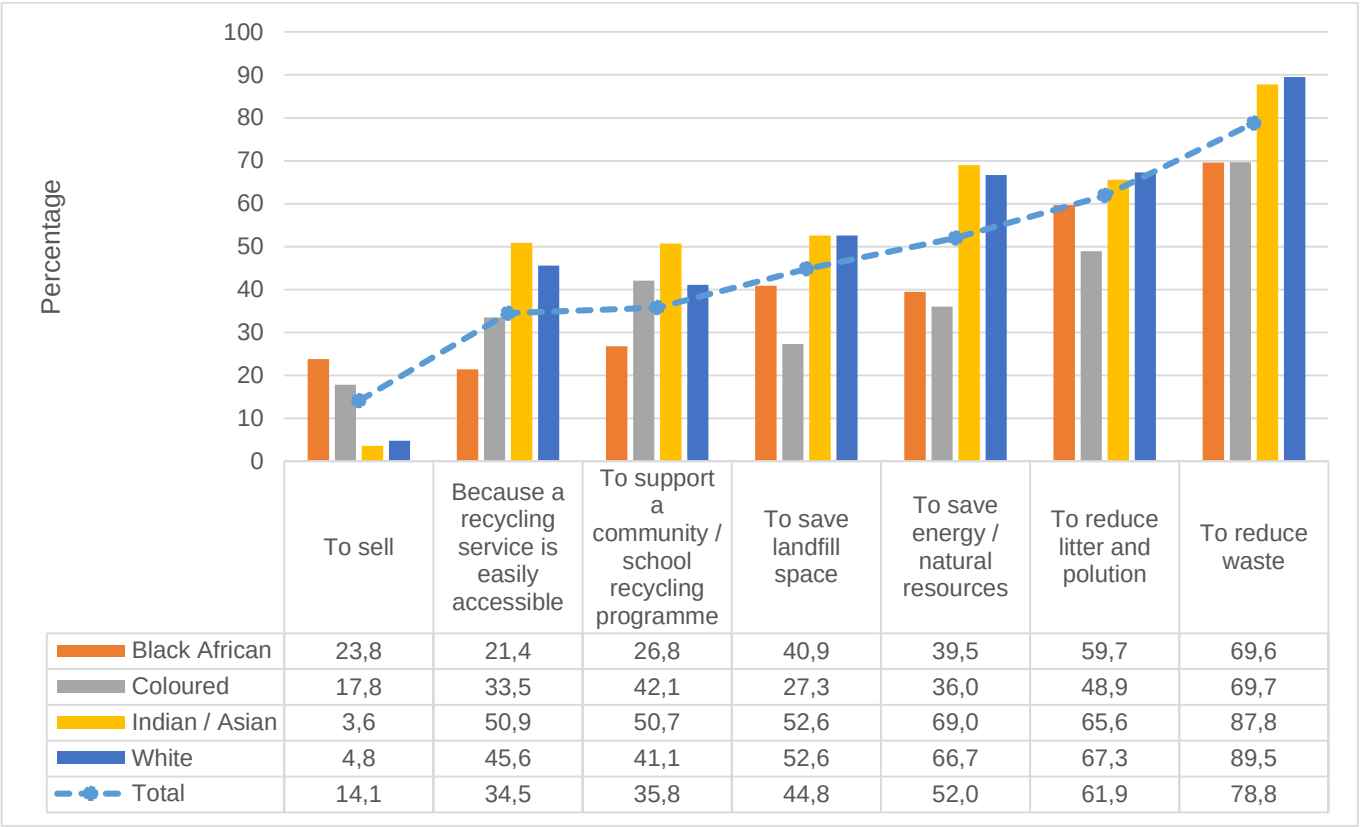


The types of products that were recycled by households are presented in Figure 4.17. The figure shows that 81,5% of households recycled plastic and plastic products (bags and bottles), followed by 75,6% that recycled glass and glass bottles. About six-tenths of households recycled paper and cardboard while 44,8% recycled aluminium and other metals. It is, unfortunately, not clear from the questionnaire how much, or how regularly households recycle these items. This is a severe limitation in the questionnaire that will be addressed at the next opportunity recycling questions are asked.

4.8 Households reasons for recycling or failing to do so

The reasons that households reported for supporting recycling are presented in Figure 4.18. The figure shows that more than three-quarters (78,8%) of households supported recycling in order to reduce waste, while another 61,9% wanted to reduce litter and pollution. Just over one-half (52%) wanted to save energy and/or natural resources while 44,8% wanted to prolong the use of landfills by reducing the amount of waste that are dumped there. Only 14,1% of households engaged in recycling in order to sell waste.

Figure 4.18: Household reasons for recycling in urban areas by population group of the household head, 2015

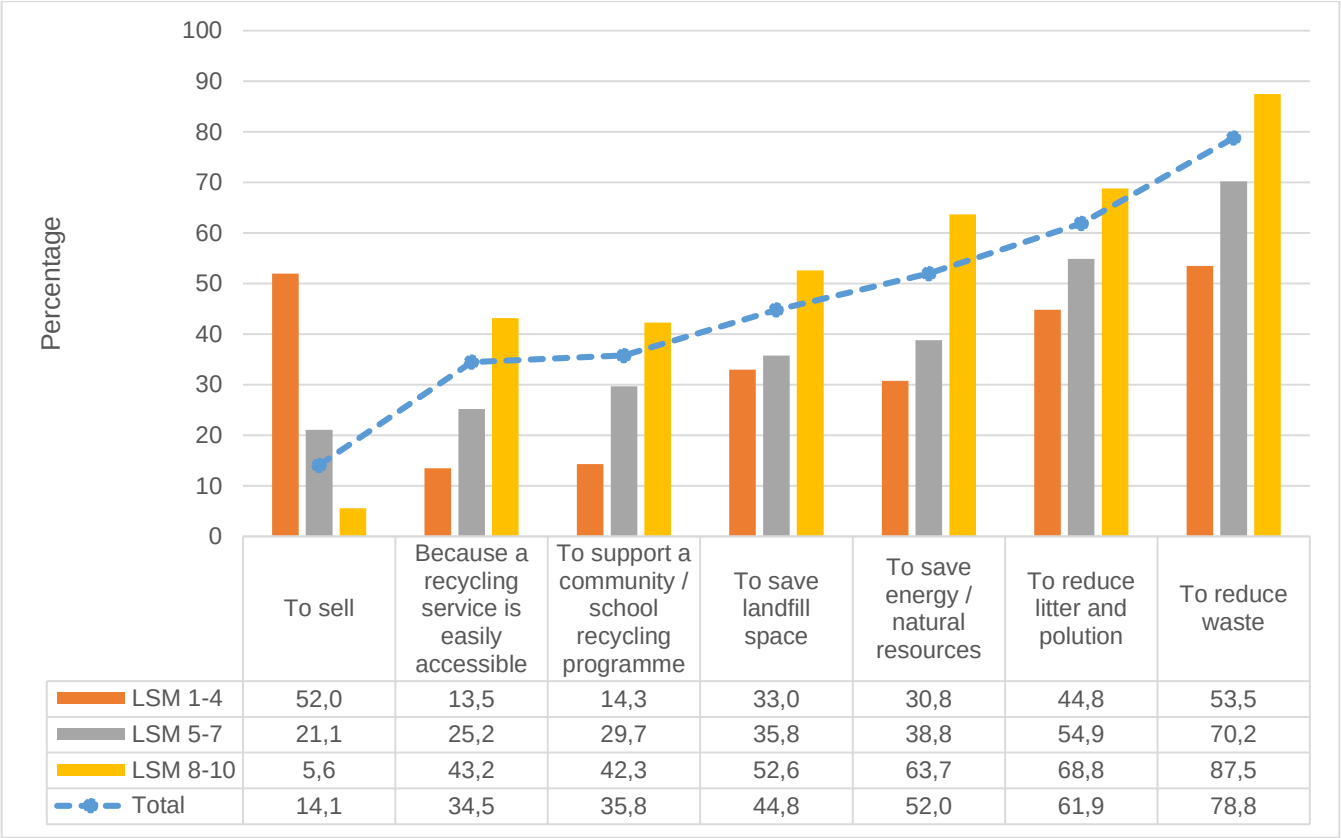


	To sell	Because a recycling service is easily accessible	To support a community / school recycling programme	To save landfill space	To save energy / natural resources	To reduce litter and polution	To reduce waste
Black African	23,8	21,4	26,8	40,9	39,5	59,7	69,6
Coloured	17,8	33,5	42,1	27,3	36,0	48,9	69,7
Indian / Asian	3,6	50,9	50,7	52,6	69,0	65,6	87,8
White	4,8	45,6	41,1	52,6	66,7	67,3	89,5
Total	14,1	34,5	35,8	44,8	52,0	61,9	78,8

More than one-fifth (23,8%) of black African-headed households indicated that they recycled waste to sell compared to only 4,8% of white-headed households. The reduction of waste was the most common reason across all race groups, although more white and Indian/Asian-headed households gave this reason than households with black African or coloured heads. Large variations between households from different population groups were also evident with regard to the option ‘to save energy/natural resources’, and to a lesser extent for the option ‘to save landfill

space'. Both options were most common for white and Indian/Asian-headed households. The percentages of black African, coloured, Indian/Asian and white households that recycled because the service was easily accessible, or in order to support a community or school programme looked very similar. This confirms the value of having opportunities for recycling available if households wanted to participate.

Figure 4.19: Household reasons for recycling in urban areas by Living Standard Measure, 2015

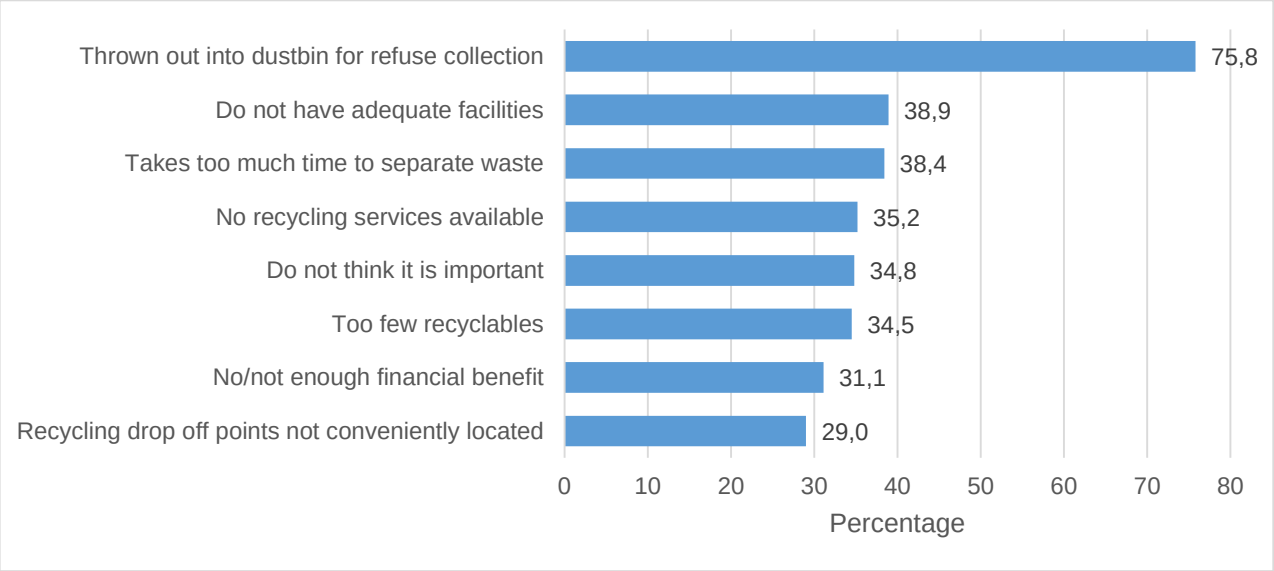


	To sell	Because a recycling service is easily accessible	To support a community / school recycling programme	To save landfill space	To save energy / natural resources	To reduce litter and polution	To reduce waste
LSM 1-4	52,0	13,5	14,3	33,0	30,8	44,8	53,5
LSM 5-7	21,1	25,2	29,7	35,8	38,8	54,9	70,2
LSM 8-10	5,6	43,2	42,3	52,6	63,7	68,8	87,5
Total	14,1	34,5	35,8	44,8	52,0	61,9	78,8

Households' reasons for recycling by their respective living standard measure classifications are presented in Figure 4.19. The figure shows that selling waste was most common for households in the lowest LSM category and least common amongst the wealthiest households (52% compared to 5,6%). The rest of the options were most commonly selected by households in LSM 8-10, followed by households in LSM 5-7, and finally LSM 1-4. Almost nine-tenths (87,5%) of LSM 8-10 households reported that they recycled waste in order to reduce waste.

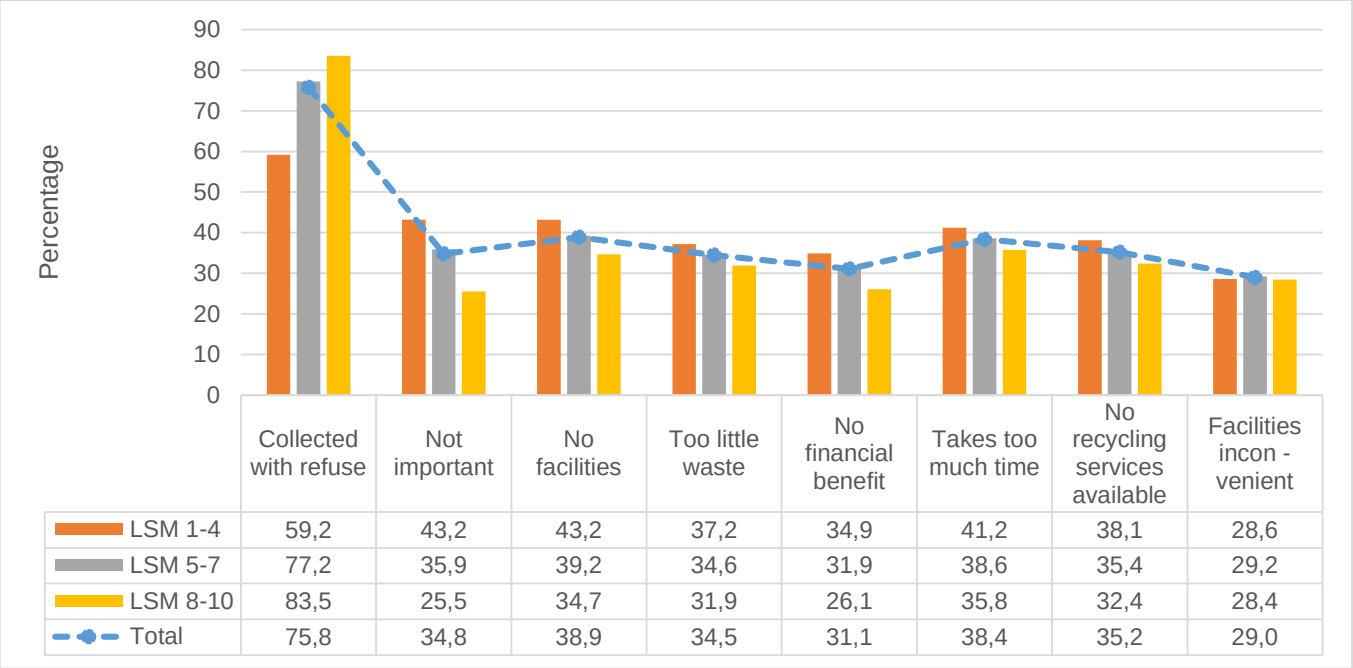
Although the environmental and ethical value of engaging in recycling seems clear, the vast majority of households do not recycle their post-consumer household waste. Although structural factors such as access to refuse removal services and facilities, as well as housing conditions undoubtedly contribute to low household recycling rates, household behaviour could also be influenced by household perceptions and knowledge. In order to gauge some of these reasons, households that did not separate waste for recycling were asked to indicate their reasons by answering yes or no to a set of options that were put to them. Household responses are presented in Figure 4.20.

Figure 4.20: Household reasons for not sorting waste for recycling in urban areas, 2015



More than three-quarters (75,8%) of households that did not separate waste for recycling responded that they did not need to recycle as they could merely throw their waste in the dustbin for refuse collection (Figure 4.20). This figure shows some indifference towards recycling, and arguably the environment, while also highlighting the importance of convenience to households. Far less common, 38,9% of households said that they did not have adequate facilities (space) to sort waste; that it took too much time to sort waste (38,4%); and that no recycling services were available (35,2%). On the bright side, 'only' 34,8% thought that recycling was not important. The least common reason related to the absence of conveniently located recycling facilities such as buy-back centres of drop-off points.

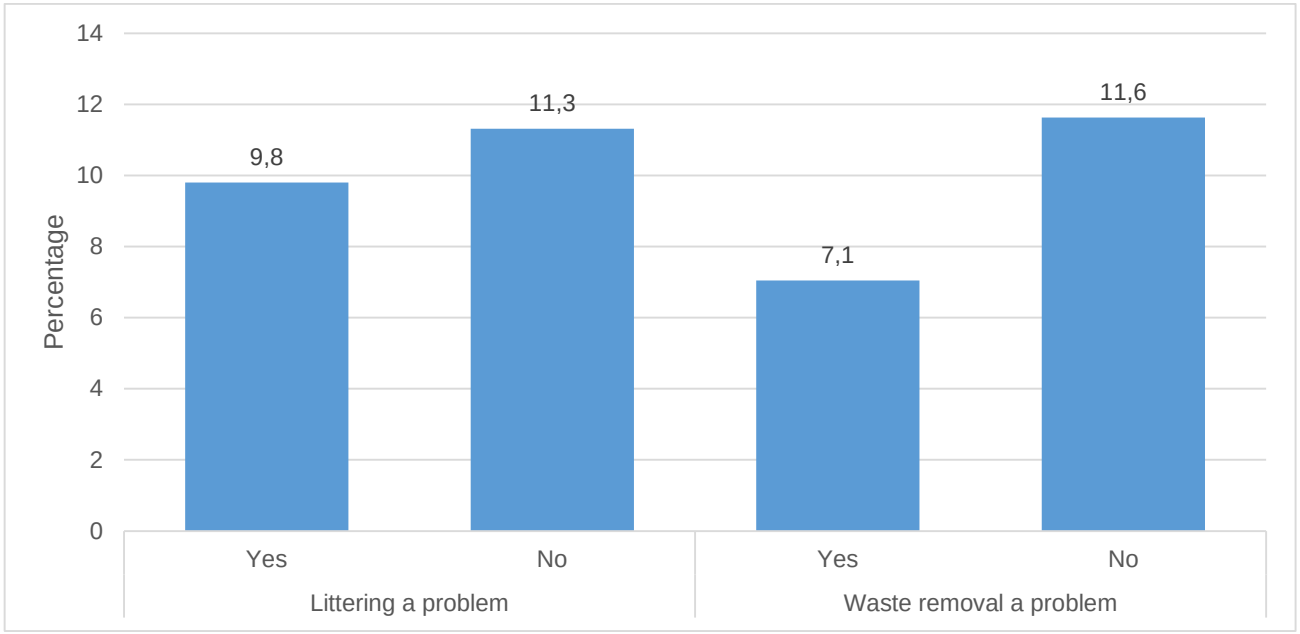
Figure 4.21: Household reasons for not sorting waste for recycling in urban areas by broad LSM categories, 2015



	Collected with refuse	Not important	No facilities	Too little waste	No financial benefit	Takes too much time	No recycling services available	Facilities incon - venient
LSM 1-4	59,2	43,2	43,2	37,2	34,9	41,2	38,1	28,6
LSM 5-7	77,2	35,9	39,2	34,6	31,9	38,6	35,4	29,2
LSM 8-10	83,5	25,5	34,7	31,9	26,1	35,8	32,4	28,4
Total	75,8	34,8	38,9	34,5	31,1	38,4	35,2	29,0

With a few exceptions, very little variation exists between households in different LSM categories in terms of the reasons provided for not participating in recycling. Figure 4.21 shows that having waste collected as refuse was the most common reason for households in LSM 8-10 and least common for households in LSM 1-4 category. Although this might have to do with wealthier households being more easy-going, it may also be a reflection of the fact that a smaller percentage of poorer households have access to kerbside refusal removal. In addition to be much less general, the other options differed in one notable respect from the first reason, the reasons are consistently more common for households in LSM 1-4 than for households in the other two LSM categories.

Figure 4.22: Percentage of urban households that sorted refuse for recycling by their experience of environmental problems, 2015

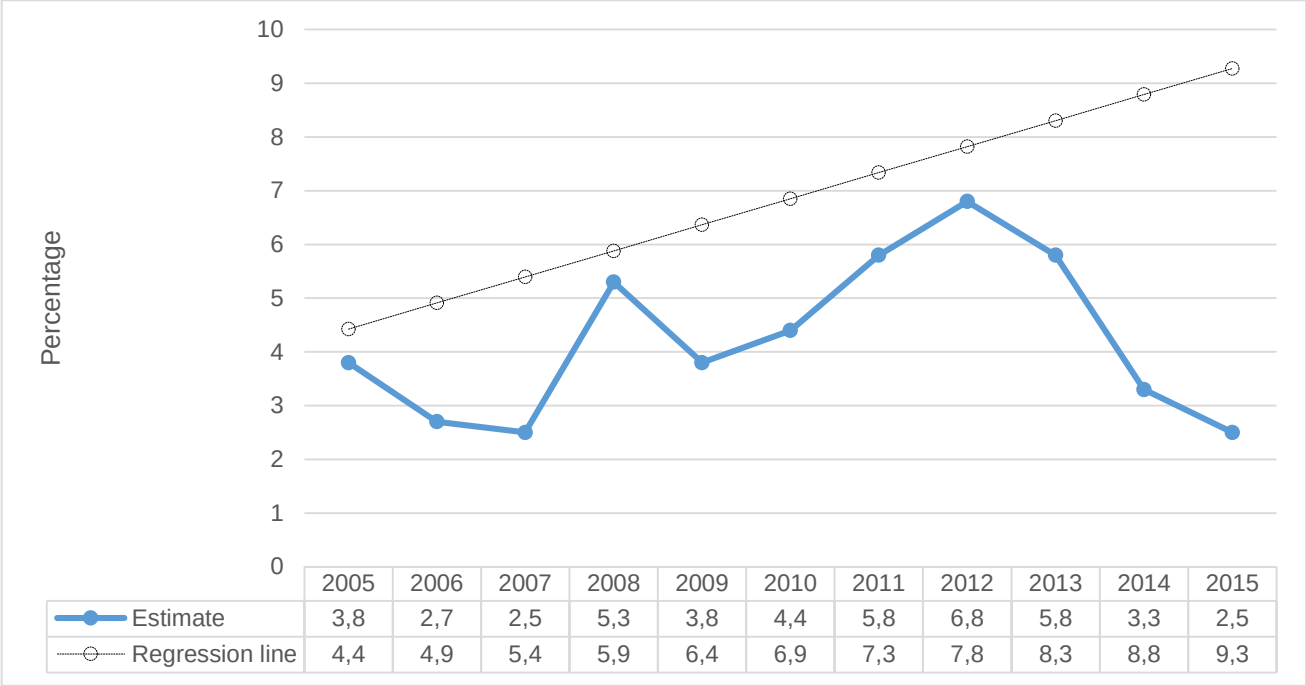


Although one would expect households that considered littering and, perhaps to a lesser extent, waste removal as problems to be engaged in recycling in order to contribute to improving the situation, Figure 4.22 shows that only a fraction of households that considered littering or waste removal as problems were engaged in recycling. Of the households that considered littering and waste removal as a problem, only 9,8% and 7,1% were respectively participating in recycling. In fact, recycling was more common amongst households that did not consider littering (11,3%) or waste removal (11,6%) as problems.

4.9 Collection of waste for recycling

Although this section has hitherto focused on cross-sectional data from GHS 2015, the section is concluded by briefly exploring a question on recycling that has been asked in the GHS since 2005. The question namely asks whether households 'collected waste for recycling'. This, semantically, differs from the question asked in 2014 and 2015 which enquired whether households 'sorted waste for recycling' in that it would probably also include households that make a livelihood out of recycling by actively collecting materials to sell at buy-back centres. The estimates recorded since 2005 is presented in Figure 4.23.

Figure 4.23: Percentage of urban households that collected waste for recycling, 2005-2016



	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Estimate	3,8	2,7	2,5	5,3	3,8	4,4	5,8	6,8	5,8	3,3	2,5
Regression line	4,4	4,9	5,4	5,9	6,4	6,9	7,3	7,8	8,3	8,8	9,3

Figure 4.23 shows that the percentage of households that collected waste for recycling has declined over the period (from 3,8% to 2,5%) after varying tumultuously. After falling to 2,5% in 2007, the percentage of households that collected waste increased to 5,3% the next year before declining again and increasing more slowly to 6,8% in 2012. Since 2012, the percentage of households that collected waste for recycling has declined consistently. Despite a very poor fit, a linear regression line shows that household recycling significantly lags the level that could have been expected given historical trends.

4.10 Predictors of household recycling using logistics regression

It is difficult to unequivocally establish any relationships between the dependent and independent variables from the descriptive analysis. It is therefore necessary to conduct a multivariate analysis. Since a binary dependent variable is used (whether households are recycling/not recycling), a logistic regression model is used to establish the probability of an event happening (1) or not happening (0). The model calculates an odds ratio, which are the ratio of the odds of an event occurring or not occurring. In this study we are interested in modelling the probability that households will sort waste for recycling, or not.

A logistic regression model was fit for the GHS 2015 data (the last year questions on recycling were asked) to explain the predicted odds of urban households sorting waste to recycle. The outcome variable was coded 1 for urban households that sorted waste for recycling, and 0 otherwise. The predictors are: province of residence, dwelling type, population group of the household head, highest level of education of the household head, LSM category of the household, age of the household head (continuous variable), and whether households knew of school or community recycling programmes. The variables are outlined in Table 4.1.

Table 4.1: Variables in the multivariate analysis

Variable	Coding
Dependent Variable: Household sorting waste for recycling	0 = Households not sorting waste for recycling 1 = Household sorting waste for recycling
Independent variables	
Province	All nine provinces
Dwelling type	0 = Detached single-unit housing 1 = Dwelling/room/flat in backyard 2 = Flat or apartment 3 = Informal dwelling 4 = Other 5 = Semi-detached dwelling
Population Group of the head of the household	0 = Black African 1 = Coloured 2 = Indian/Asian 3 = White
Highest level of education of household head	0 = Matric 1 = Less than matric 2 = Other tertiary 3 = Graduated 4 = Other
LSM	1 = LSM 1-4 2 = LSM 5-7 3 = LSM 8-10
Head age	Continuous age of the household head in years
School / Community recycling programme	0 = No school / community recycling programme 1 = Has a school / community recycling programme

Table 4.2 shows that urban households in Western Cape were more likely to sort waste for recycling. Households in Limpopo (-2,3 times), Northern Cape (-1,4 times) and Free State (-1,1 times) were least likely to sort waste in relation to Western Cape households. The model also shows that households that lived in detached single-unit housing (essentially formal dwellings on separate stands) were most likely to have sorted waste for recycling. Relative to households that resided in single-unit housing units, households that lived in caravans or tents were 2 times least likely to have sorted waste for recycling, while households that resided in informal settlements were 45,2% less likely to have participated. Households that were headed by whites were most likely to have sorted waste for recycling. Compared to white-headed households, households headed by black Africans were 84,9% less likely to have been involved in recycling, followed by households headed by coloureds (-70,1%) and Indian/Asians (-11%). The latter figures are, however, not statistically significant. Households with the highest living standards (LSM 8-10) were also most likely to have sorted waste for recycling. Compared to this group, households in the intermediate category (LSM 5-7) and the low LSM category (LSM 1-4) were respectively 18,9% and 36,4% less likely to have sorted waste for recycling. The latter figure is, however, not significant at the 95% level. Not surprisingly, the model shows that, compared to households headed by a person that has completed grade 12, households that are headed by persons who have graduated from university were 62,4% more likely to have sorted waste for recycling. The descriptive observation in Figure 4.6 that shows that household recycling became more common with increases in the age of the household head, is supported by the model. The model shows that the likelihood of sorting waste for recycling increased by 1,6% for every single year increase in the age of the household head. Finally, the model shows that

households that were aware of school or community recycling facilities were 1,9 times more likely as those who did not know of such facilities to sort waste for recycling.

Table 4.2: Predictors of households in urban areas that sorted waste for recycling, using logistics regression, 2015

Probability modelled	Households sorting waste for recycling in urban areas
Likelihood ratio chi-square	41 771
Hosmer and Lemeshow goodness of fit test (P-value)	0,0001
N	13 741
Intercept	-2,2680
AUC	0,801
Province	**Urban**
Western Cape (reference)	
Eastern Cape	-0,9140
Northern Cape	-1,3843
Free State	-1,1312
KwaZulu-Natal	-0,9218
North West	-0,3456*
Gauteng	-0,2547*
Mpumalanga	-0,8263
Limpopo	-2,2712
Dwelling type	
Detached single-unit housing (Reference)	
Dwelling/room/flat in backyard	-0,1491*
Flat or apartment	-0,0272*
Informal dwelling	-0,4518
Other	-1,9916
Semi-detached dwelling	-0,2745*
Population group of household head	
White (Reference)	
Black African	-0,8493
Coloured	-0,7012
Indian Asian	-0,1102*
LSM	
LSM 8-10 (reference)	
LSM 5-7	-0,3638*
LSM 1-4	-0,1893
Highest level of education of household head	
Matric (Reference)	
Less than matric	0,0410*
Other tertiary	0,3176
Graduated	0,6235
Other	0,3360*
Age of household head	
Age	0,0157
Availability of school or community recycling programme	
No programme available (reference)	
School / Community programme available	1,8934

*: Values not significant at 95% level of significance

4.11 Summary and conclusions

The implementation of the Waste Act (RSA, 2008) requires that waste is separated at household level, and that municipality's municipal waste collection services support new waste collection practices. Although the NWMS (2011) set a goal for all metropolitan municipalities, secondary cities and large towns to have initiated separation at source programmes by 2016, recycling remains inadequate. According to a baseline study conducted by the DEA (2012) only 10% of an estimated 95 million tonnes of general waste generated in 2011 was recycled. Although there are many reasons for this state of affairs, this recommendation will focus on some of the elements that were highlighted in the section. The study found that self-reported recycling was most common in metropolitan households (12,9%), followed by household across urban areas in general (10,8%) and households in rural areas (3%). Of the rural households, recycling was more common amongst households on farms (3,8%) than households in traditional areas (2,9%). Recycling was therefore most common in households with the largest urban populations. Although recycling was more common in metropolitan areas, significant variation is notable among metros. Recycling was most common in Cape Town (22,7%), Johannesburg (16,2%) and Ekurhuleni (12,7%) and least common in Mangaung (4,2%), Buffalo City (5%) and Nelson Mandela Bay (6,2%).

In terms of recycling by dwelling type, the study shows that recycling was most common in smaller, more converged housing options such as semi-detached housing (cluster and townhouses) and flats or apartments where collective refuse removal is easier to implement. Inversely, recycling was very uncommon in informal or backyard dwellings. Household recycling behaviour was also found to be closely associated with the characteristics of the householder or household head. So, for instance, recycling was most common for white-headed (28,6%) and elderly-headed (18,4%) households. A positive relationship between the age of the household head and household recycling is notable. This, unfortunately, means that households headed by individuals aged 18-24 year of age were least likely to participate in recycling.

The importance of knowledge and ability to gain knowledge is underlined by the finding that recycling was most common amongst households that were headed by individuals who have at least obtained degrees, and least common for households where the householder's highest level of education was less than matric.

Recycling was also much more common amongst the wealthiest households. Whereas 21,5% of households in LSM 8-10 category recycled waste, this was only true of 3,7% in the lowest LSM category.

Although the GHS attempted to measure the particular mode used to dispose of recycled waste, the results are varied. Nationally, similar percentages of households reported that the waste was fetched by the municipality (24,4%), taken to a drop-off point by the household (26,7%) or fetched by waste pickers (other). The use of the 'other' category which most likely refers to informal waste pickers was particularly high among black African-headed households. In the absence of a concerted recycling programme which picks up sorted waste at households, the use of drop-off points remains important.

Most households (71%) reported that waste was fetched within a week. However, whereas 90,6% of households' whose waste was fetched by municipalities had it removed within one week, about one-half of households that took waste to a drop-off point waited longer than one week, creating a need to have space and appropriate containers to store waste.

It is important to note that a much larger percentage of households that reported a community or school recycling programme engaged in recycling themselves (34,6%) compared to those that did not have such programmes (6,4%), or who did not know (5,5%). The availability of such community programmes had a particularly positive impact on recycling behaviour among households that lived in flats or apartments, semi-detached dwellings, and detached single units.

Although the GHS asked questions about the range of products that were recycled, the findings were unsatisfactory. Questions have to be revised in order to get a better sense of quantity and frequency.

Finally, questions on the reasons for recycling, or not recycling, show that recycling to sell waste was most common among the poorest households, while the wealthiest households could afford to do it for lofty ideals such as 'reducing waste' or 'saving energy and natural resources'. However, wealthy households' carelessness are exposed by questions asked of households that did not recycle. More than four-fifths (83,5%) of households in the highest LSM category indicated that they did not care to sort waste as recyclable materials were put out with the refuse for collection. This clearly point to a need to establish some kind of incentive for recycling.

As with waste, it is important that more information about recycling is made available. Although questions on recycling have been carried in the GHS since 2005 and longer modules were included in 2014 and 2015, the level of disaggregation is limited to provincial level. No recycling questions have ever been included in the census or the community survey which could have provided data on sub-provincial levels. While very detailed, surveys conducted by the CSIR also had a limited sample size. The need for better data, however, transcends sample size as the questions themselves should also be reviewed with a view to get more accurate, yet flexible measures of recycling. In addition to measuring participation in absolute yes or no terms, questions should also allow for a more nuanced assessment of the frequency and volumes involved in recycling.

5 Environmental consciousness

5.1 Introduction

Section 24 of South Africa's Bill of Rights outlines the right of each South African to an environment that is not harmful to their health or well-being, as well as the right to ecologically sustainable development (RSA, 1996). Although a broad range of environmental protection legislation is attempting to give effect to these provisions, households' perceptions of the environment is affected by their demographic and socio-economic characteristics.

Environmental concern consists of various attitudes and behaviours towards the environment. Although environmental attitudes have been discussed widely, and measures frequently, they remain relatively poorly understood. The terminology used ranges from environmental concern/awareness/perceptions or consciousness. These terminological differences highlight the vast array of conceptualisations of environmental concern and will be used interchangeably in this paper. According to Inglehart (1990, 1997) the way that people view the environment is, at least partially, dependent on the material resources that are available to members. Individuals that are preoccupied with a struggle to access material goods might be less concerned in environmental protection, viewing it as a resource to be utilized. However, once the basic needs are satisfied, individuals will be more likely to embrace abstract principles such as quality of life, and environmental integrity. Alternative theories have, however, been offered. The environmental deprivation theory, for instance, argues that individuals' concern for the environment would increase the more they are exposes to environmental degradation as it becomes a survival concern. By contrast, the relative deprivation theory argues that people that live in environmentally degraded areas get used to it and that they often fail to observe the pollution (Whittaker et al, 2003).

5.2 Objectives

The main objective of this section is to explore the relationship between households' demographic, socio-economic and geographical characteristics and their experience of six individual environmental problems, as well as their experience of multiple problems. Literature specifically emphasizes the persistence of race and ethnicity as a factor to explain variations in perceptions about environmental matters, although these are often mediated by local geographic conditions. This section will furthermore investigates environmental consciousness in South African in terms of these household characteristics.

A set of questions on perceptions about experience of environmental problems have been asked in the GHS since 2003. When the questions were first asked in 2003, littering and no waste removal were grouped together, however from 2009 onwards they were asked separately. The perception about experience of excessive noise or noise pollution was included from 2005 onwards.

5.3 Household experiences of environmental problems

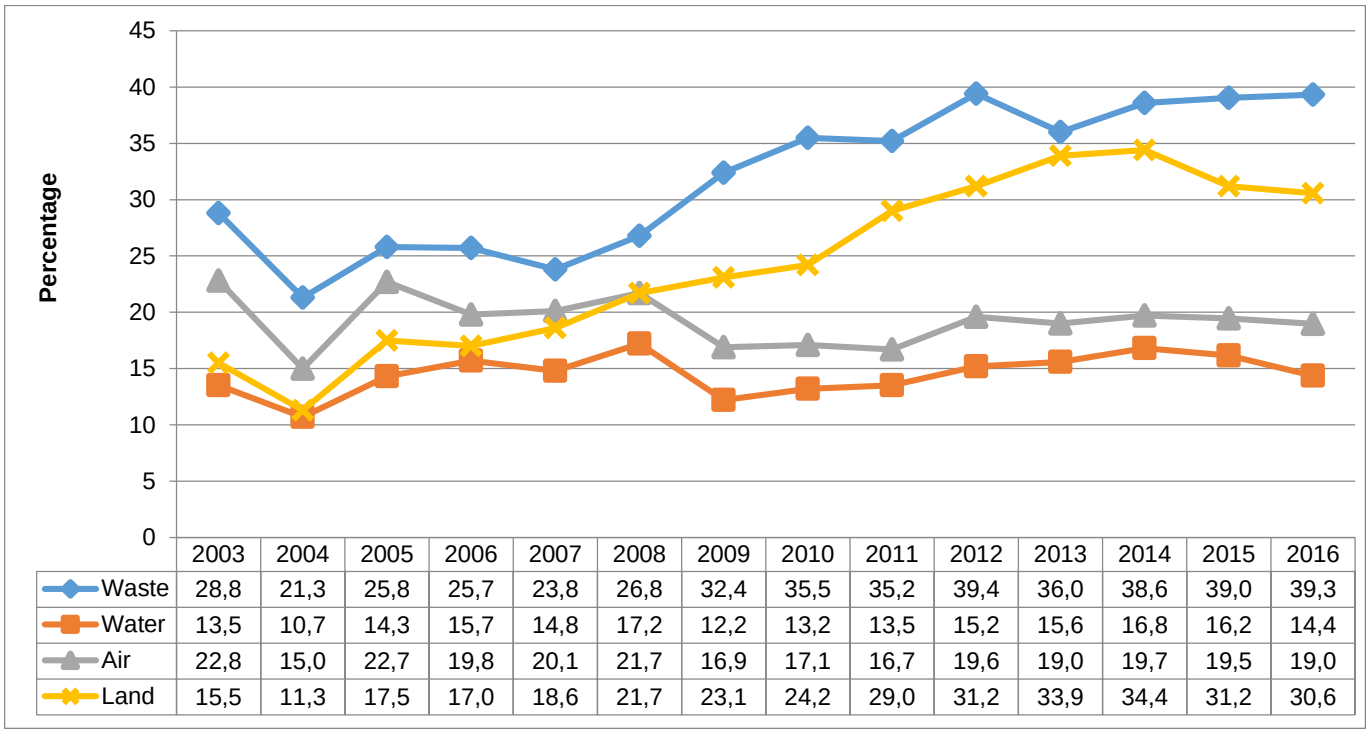
The state of households' local environments can have a far-reaching impact on their social and economic well-being. While households that live in rural areas often have to rely on their surrounding environment to produce and income and to meet their daily needs, urban households are often exposed to environments that could be harmful to health

and social well-being. Despite these hazards, households continue to live in a precarious interaction with their environments. Relatively little is, however, known about household's environmental perceptions and concerns.

5.3.1 Environmental problems experienced by households according to their geographical characteristics

Household perceptions of their environment are explored using a set of questions first asked in the GHS in 2003 on whether households experienced a list of environmental problems in their communities, farms or neighbouring farms. The environment is defined broadly to include a households' natural surroundings, including the air, water and land, as well as the condition of those resources, as measured through their perceptions of littering, water pollution, land degradation and noise pollution.

Figure 5.1: Percentage of households who experience specific kinds of environmental problems, 2003 – 2016



	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Waste	28,8	21,3	25,8	25,7	23,8	26,8	32,4	35,5	35,2	39,4	36,0	38,6	39,0	39,3
Water	13,5	10,7	14,3	15,7	14,8	17,2	12,2	13,2	13,5	15,2	15,6	16,8	16,2	14,4
Air	22,8	15,0	22,7	19,8	20,1	21,7	16,9	17,1	16,7	19,6	19,0	19,7	19,5	19,0
Land	15,5	11,3	17,5	17,0	18,6	21,7	23,1	24,2	29,0	31,2	33,9	34,4	31,2	30,6

Figure 5.1 summarises environmental problems experienced by household in the area they live. The figure reveals that waste removal problems and littering (39,3%) as well as land degradation and soil erosion (30,6%) were the two environmental problems that concerned the highest percentage of households in 2016. The percentage of households that considered land degradation and soil erosion a problem increased from 15,5% in 2003 to 30,6% in 2016. The proportion of households that felt that there were problems with littering and waste removal in their areas increased notably since 2003 when 28,8% of households regarding this as a problem. Households that considered air pollution to be a problem decreased from 22,8% in 2003 to 19,0% in 2016.

Table 5.1: Percentage of households who experience specific kinds of environmental problems, 2016

	No waste removal	Littering	Water pollution	Air pollution	Land degradation	Noise pollution
Western Cape	7,2	24,2	10,4	11,3	10,8	13,9
Eastern Cape	23,8	28,4	14,3	13,7	38,7	14,2
Northern Cape	35,3	40,0	16,3	24,5	27,8	15,7
Free State	42,0	46,9	19,3	24,1	48,4	22,8
KwaZulu-Natal	30,9	38,9	21,1	18,5	26,2	13,0
North West	26,5	31,0	14,5	29,6	51,5	18,2
Gauteng	14,8	30,0	12,6	18,6	19,9	16,8
Mpumalanga	59,3	54,4	13,7	30,0	64,3	13,3
Limpopo	21,0	27,2	9,5	14,5	32,4	17,7
South Africa	**24,3**	**33,5**	**14,4**	**19,0**	**30,6**	**15,8**

Although literature shows that it is very difficult to generalize conceptualisations of environmental concern across different geographic and cultural contexts (Hunter, Strife and Twine, 2010), Table 5.1 seems to show some provincial variation in the environmental problems experienced by households. The table shows that the highest percentages of each environmental problem were observed in Mpumalanga, Free State, Northern Cape and North West. There was no visible pattern as far as noise pollution is concerned.

Table 5.2: Percentage of households who experience specific kinds of environmental problems, by metro, 2016

	No waste removal	Littering	Water pollution	Air pollution	Land degradation	Noise pollution
Tshwane	15,1	25,9	14,5	17,3	23,1	12,3
Johannesburg	15,9	34,5	14,9	14,0	19,5	19,8
Ekurhuleni	10,5	25,7	8,7	22,8	11,9	16,5
eThekwini	37,1	43,8	18,7	20,9	20,3	19,2
Mangaung	31,9	36,9	12,6	25,7	40,0	27,8
Nelson Mandela Bay	17,2	22,6	3,8	9,0	1,9	4,4
Buffalo City	31,2	42,2	31,4	35,7	50,4	36,4
Cape Town	8,7	27,6	13,9	13,7	13,5	18,9
All metros	**17,9**	**31,6**	**14,1**	**17,9**	**18,8**	**17,9**

Noise pollution problems concerned over one-third of households that lived in Buffalo City (36,4%) and 27,8% of households in Mangaung. By contrast, only 4,4% of households in Nelson Mandela Bay were concerned about noise pollution.

Littering was a general environmental problem as far as metros were concerned with the highest percentages reported for eThekwini (43,8%), Buffalo City (42,2%) and Mangaung (36,9%). The problem was least commonly noted by 22,6% of households in Nelson Mandela Bay. Insufficient waste removal services were most common in eThekwini (37,1%), Mangaung (31,9%) and Buffalo City (31,2%), and least common in Cape Town (8,7%). This is presented in table 5.2.

It is notable that more than one-half (50,4%) of households in Buffalo City, and 40% of households in Mangaung noted land degradation as an environmental problem compared to 1,9% of households in Nelson Mandela Bay and

11,9% of households in Ekurhuleni. In terms of perceived water pollution, Table 5.2 shows that 31,4% of households in Buffalo City considered that a problem compared to 3,8% in Nelson Mandela Bay.

Figure 5.2: Percentage of households who experience specific kinds of environmental problems by rural/urban, 2016

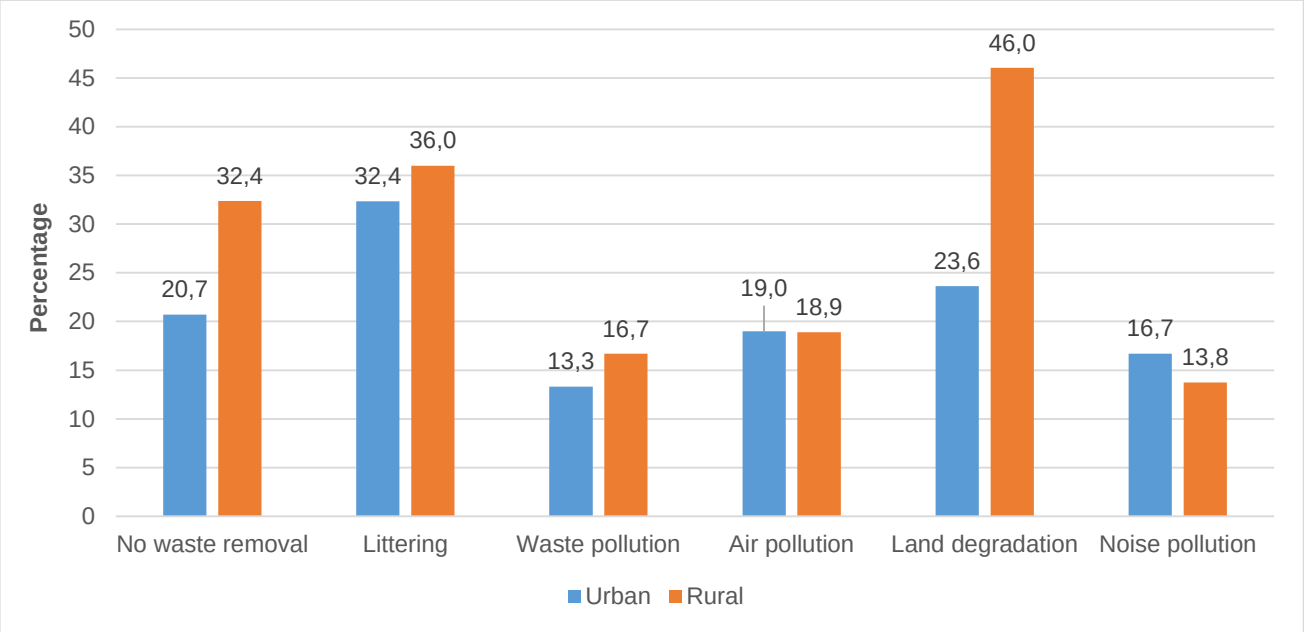
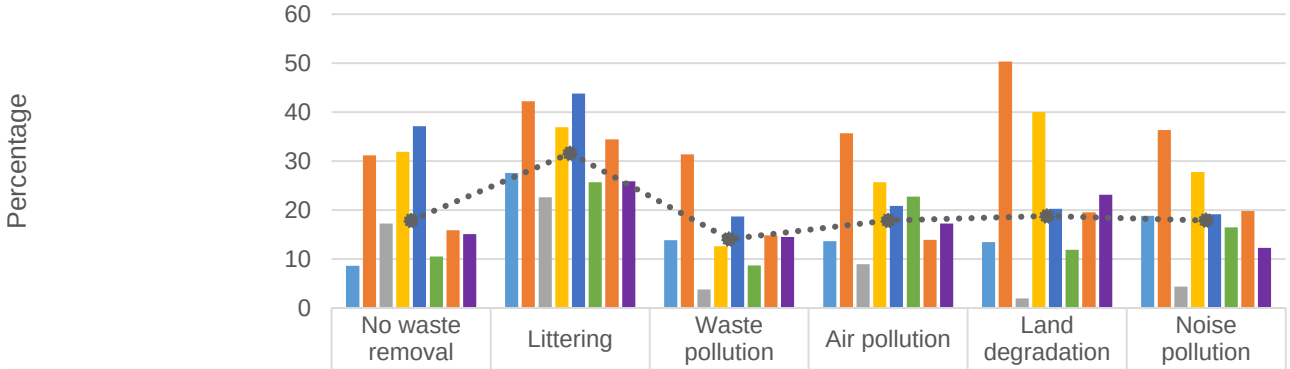


Figure 5.2 shows that households living in rural areas seemingly experienced more environmental problems when compared to households that lived in urban areas. It is particularly notable how much more common perceptions of land degradation was amongst rural households compared to urban households (46,0% compared to 23,6%). Noise pollution was the only environmental concern that affected urban households more severely than rural households.

Figure 5.3: Percentage of households who experienced experience specific kinds of environmental problems by metropolitan area, 2016



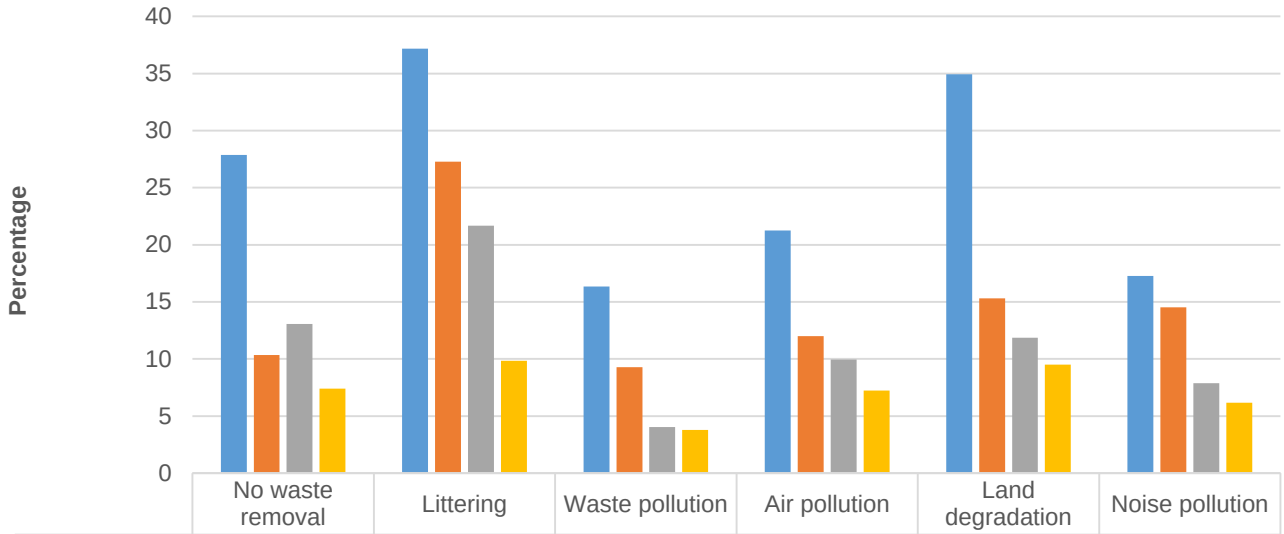
	No waste removal	Littering	Waste pollution	Air pollution	Land degradation	Noise pollution
City of Cape Town	8,7	27,6	13,9	13,7	13,5	18,9
Buffalo City	31,2	42,2	31,4	35,7	50,4	36,4
Nelson Mandela Bay	17,2	22,6	3,8	9,0	1,9	4,4
Mangaung	31,9	36,9	12,6	25,7	40,0	27,8
eThekwini	37,1	43,8	18,7	20,9	20,3	19,2
Ekurhuleni	10,5	25,7	8,7	22,8	11,9	16,5
City of Johannesburg	15,9	34,5	14,9	14,0	19,5	19,8
City of Tshwane	15,1	25,9	14,5	17,3	23,1	12,3
All metros	17,9	31,6	14,1	17,9	18,8	17,9

Households' perceptions of their environments vary notably between different metropolitan areas. Figure 5.3 shows that negative perceptions were most common among households in Buffalo City and Mangaung across most categories, although eThekwini stands out in terms of littering and a lack of waste removal. On the opposite end of the spectrum, households from Nelson Mandela Bay seemed much more content with their immediate environments.

5.3.2 Environmental problems experienced by households according to their household characteristics

This section will investigate the socio-economic and demographic factors associated with environmental concern. Anderson, Romani, Phillips, Wentzel and Tlabela (2007) reports that households that were most likely to be affected by particular environmental problem, such as water pollution, were most likely to also perceive it as environmental concerns. This argument seems to be aligned to the environmental deprivation theory outlined earlier. Hunter et al (2010) also argue that environmental orientations could be shaped by cultural and geographic orientations.

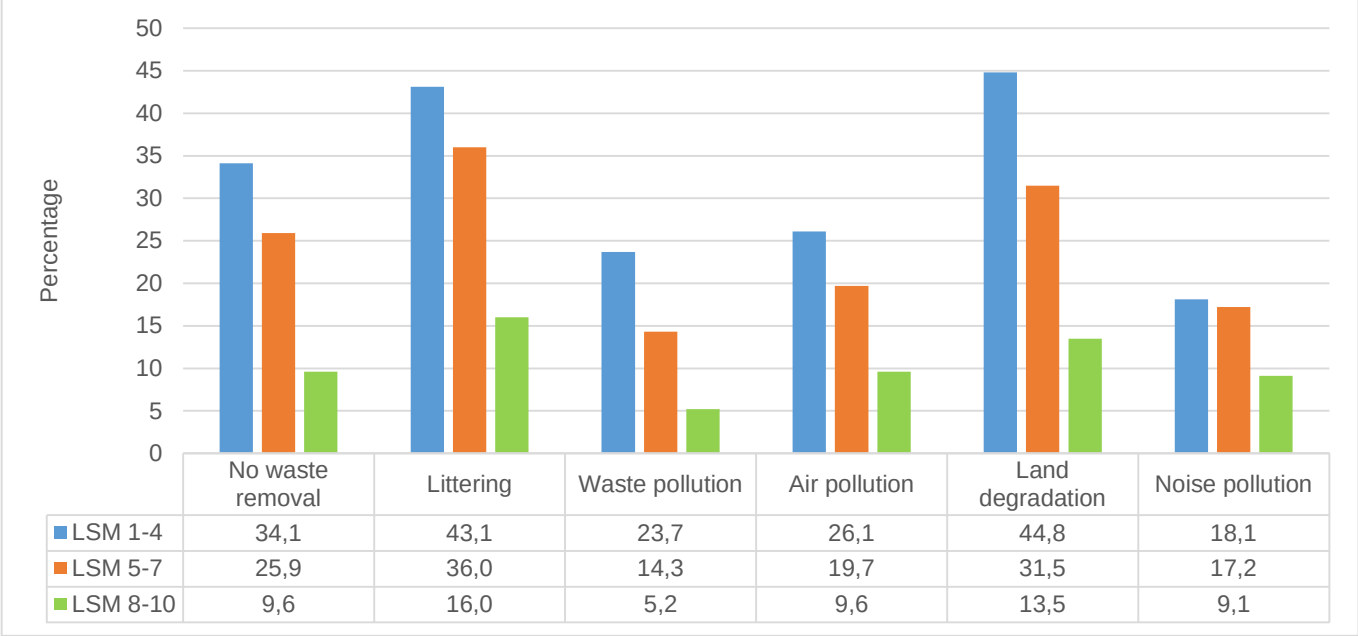
Figure 5.4: Percentage of households who experience specific kinds of environmental problems by population group of the household head, 2016



	No waste removal	Littering	Waste pollution	Air pollution	Land degradation	Noise pollution
Black African	27,9	37,2	16,3	21,2	34,9	17,3
Coloured	10,3	27,3	9,3	12,0	15,3	14,5
Indian / Asian	13,1	21,7	4,0	10,0	11,9	7,9
White	7,4	9,9	3,8	7,2	9,5	6,2

Figure 5.4 shows that negative perceptions about the environments were consistently more common among all categories for households headed by black Africans, while white-headed households were least likely to harbour negative perceptions. Black African-headed households felt particularly strongly about littering (37,2%) and land degradation (34,9%).

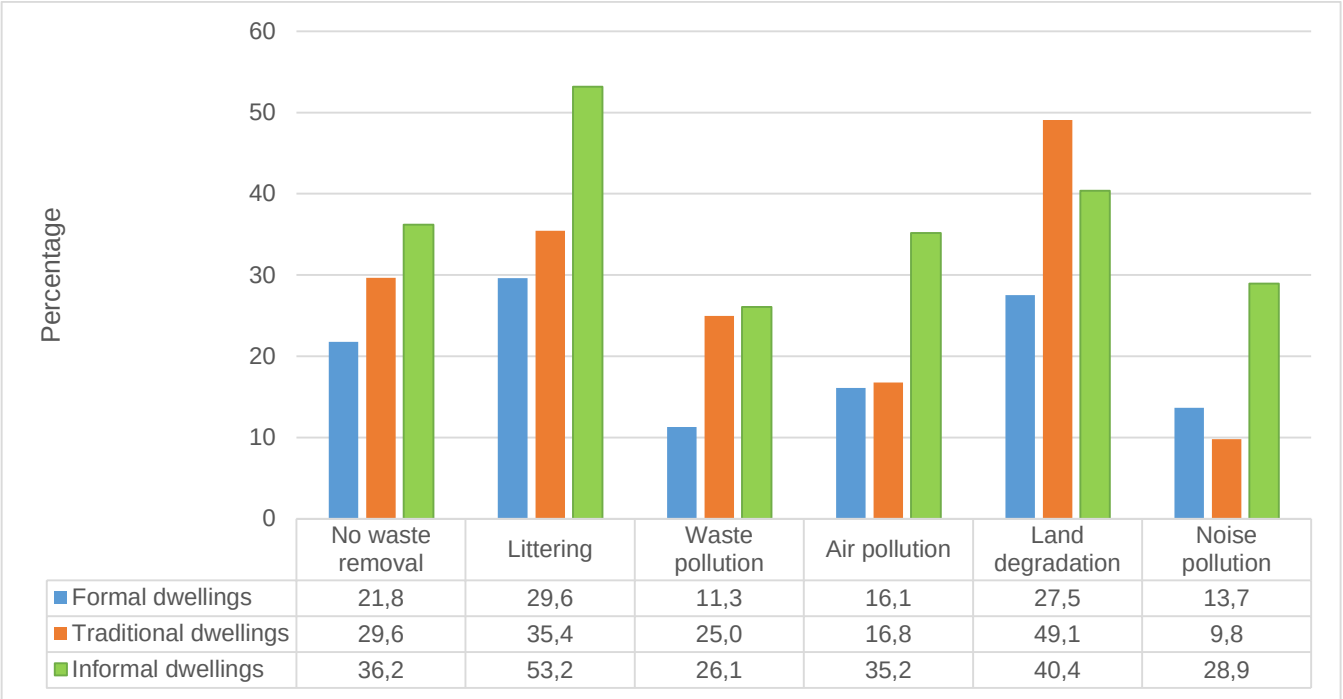
Figure 5.5: Percentage of households who experience specific kinds of environmental problems by household LSM-classification, 2016



	No waste removal	Littering	Waste pollution	Air pollution	Land degradation	Noise pollution
LSM 1-4	34,1	43,1	23,7	26,1	44,8	18,1
LSM 5-7	25,9	36,0	14,3	19,7	31,5	17,2
LSM 8-10	9,6	16,0	5,2	9,6	13,5	9,1

The association between household wealth and perceptions of the environment is explored in Figure 5.5. The figure shows that negative environmental perceptions were most common amongst households in the lowest LSM category and amongst the wealthiest households. It is notable how much less most environmental problems are perceived by wealthy households compared to their poorer counterparts. Like Figure 5.4, land degradation and littering stand out with the highest negative perceptions ratings across all LSM categories. More than four-tenths of households in the lowest LSM category felt that land degradation (44,8%) and littering (43,1%) were problems.

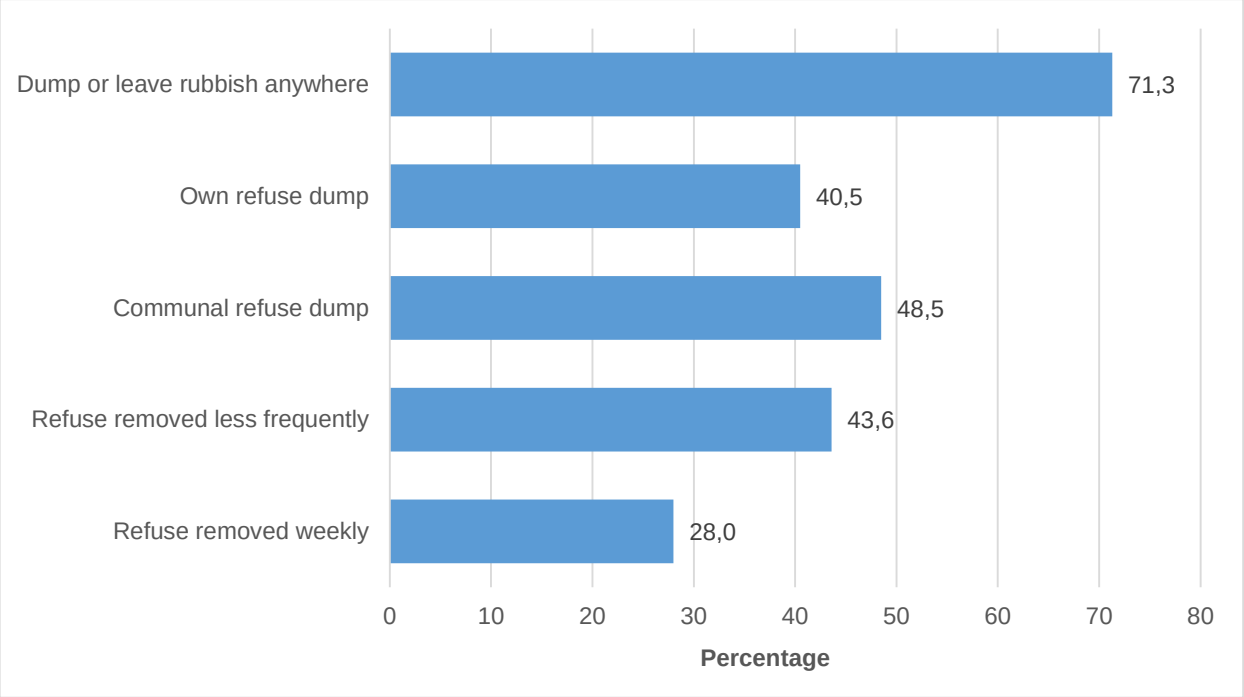
Figure 5.6: Percentage of households who experience specific kinds of environmental problems type of dwelling inhabited by the household, 2016



	No waste removal	Littering	Waste pollution	Air pollution	Land degradation	Noise pollution
Formal dwellings	21,8	29,6	11,3	16,1	27,5	13,7
Traditional dwellings	29,6	35,4	25,0	16,8	49,1	9,8
Informal dwellings	36,2	53,2	26,1	35,2	40,4	28,9

Households that lived in informal dwellings were most likely to experience environmental problems, followed by households in traditional dwellings. A much smaller percentage of households that lived in formal dwellings experienced environmental problems. It is worth noting that land degradation was most common amongst traditional dwellers. This is depicted in figure 5.6.

Figure 5.7: Percentage of households who experienced littering by mode of waste disposal, 2016



The findings of figure 5.7 show that 71,3% of households that did not have access to adequate solid waste management, considered littering a problem. This observation supports an argument by Anderson et al (2007) that households who are most likely to be affected by an environmental concern will be concerned about it. Concern about littering was least common (28,0%) amongst households whose waste were removed on a weekly basis.

5.3.3 Multivariate analysis of household experiences of environmental problems

Four logistic regression models were fitted to test the relationship between four dependent variables (littering, water pollution, air pollution, and land degradation) and a set of independent predictor variables. The outcome variables were coded 1 for the probability that households experienced a particular environmental problem, and 0 otherwise. The predictor variables were: province, geographical location, dwelling type, living standard measure, and population group of the household head.

Table 5.3: Predictors of households experience of various environmental problems using logistic regression, 2016

Probability modelled	Experience of water various environmental problems			
	Littering	Water pollution	Air pollution	Land degradation
Likelihood ratio chi-square	32 860	18 747	20 142	48 700
Hosmer and Lemeshow goodness of fit test (P-value)	0,0001	0,0001	0,0001	0,0001
N	21 218	21 218	21 218	21 218
Intercept	2,5894	3,4262	3,0607	3,1904
AUC (Model fit)	0,668	0,670	0,661	0,724
Maximum Likelihood Estimates				
Province	**Littering**	**Water pollution**	**Air pollution**	**Land degradation**
Western Cape (reference category)				
Eastern Cape	-0,0542*	0,0515*	-0,1487*	-1,1161
Northern Cape	-0,6373	-0,3771*	-0,9298	-0,9057
Free State	-0,8444	-0,4342	-0,7424	-1,8200
KwaZulu-Natal	-0,5613	-0,5116	-0,5226	-0,5721
North West	-0,0631*	0,0437*	-1,0356	-1,6758
Gauteng	-0,1576*	0,0342*	-0,4090	-0,5784
Mpumalanga	-1,1812	0,00699*	-1,1650	-2,2098
Limpopo	0,0168*	0,4533	-0,2731*	-0,7261
Geographical location				
Urban (reference category)				
Rural	0,0697*	-0,0256*	0,2564	-0,5915
Dwelling type				
Formal (reference category)				
Traditional	0,0636*	-0,3746	0,0406	-0,4220
Informal	-0,7909	-0,7397	-0,7817	-0,6165
Other	-1,0399	-1,2397	-1,0876	-0,4280*
Living Standard measure				
High (reference category)				
Low	-0,7357	-0,9348	-0,6868	-0,4855
Medium	-0,5485	-0,5735	-0,4023	-0,3626
Population group of household head				
White (reference category)				
Black African	-1,0548	-0,8633	-0,6825	-0,8293
Coloured	-0,9410	-0,4739	-0,3883	-0,5956
Indian / Asian	-0,6415	0,3465*	-0,1831*	-0,3625*

* Insignificant values at 95%.

Table 5.3 shows that out that geographic location was statistically significant for land degradation and air pollution. Due to the fact that few sampled households were headed by Indian/ Asians, only the estimate for littering was statistically significant. Households that lived in Western Cape were less likely to experience littering, air pollution land degradation. Similarly, households headed by whites, households in LSM 1-10 category, and those that lived in formal dwellings were, generally, least likely to have experienced littering, water pollution, air pollution and land degradation. As an exception, households that lived in traditional dwellings were 4% less likely to have experienced air pollutions than households that lived in formal dwellings. Coincidentally, the AUC is close to 0,67 for littering,

water and air pollution meaning the variables in the model are not good predictors or some variables might have been left out. Land degradation had a slightly higher AUC figure of 0,724 meaning that compared to the other three environmental problems, the variables were better predictors for the former that the latter, however, the logistic regression is still not a good fit.

5.4 Combined environmental problems

An analysis of individual environmental problems was done in section 5.1. it is, however, possible for households to experience more than one environmental problem. This report adopts the methodology used by (Anderson, Romani, Wentzel & Philips, 2010) in the journal titled exploring environmental consciousness in South African published by University of Michigan in 2010. According to Anderson *et al.*, 2010; some households were most likely to experience at least one environmental problem. The four environmental problems that were grouped together are littering, water pollution, air pollution and land degradation.

Table 5.4: Environmental problems correlation matrix

	No waste removal	Littering	Water pollution	Air pollution	Land degradation	Noise pollution
No waste removal	1,00	0,52	0,28	0,29	0,34	0,20
Littering	0,52	1,00	0,38	0,40	0,38	0,37
Water pollution	0,28	0,38	1,00	0,49	0,32	0,31
Air pollution	0,29	0,40	0,49	1,00	0,39	0,44
Land degradation	0,34	0,38	0,32	0,39	1,00	0,29
Noise pollution	0,20	0,37	0,31	0,44	0,29	1,00

Environmental problems correlation matrix is presented in Table 5.4. The correlation matrix numbers measure the strength and direction of the linear relationship between the two variables. The correlation coefficient ranges from -1 to +1, with -1 indicating a perfect negative correlation, +1 indicating a perfect positive correlation, and 0 indicating no correlation at all. A variable correlated with itself will always have a correlation coefficient of 1. Values in the table indicate a weak positive correlation between variables whilst higher values are reported for no waste removal and littering (0,52); water and air pollution (0,49). All the values were significant at five per cent. No waste removal and noise degradation seem to be the least correlated with other variables and this supports the findings

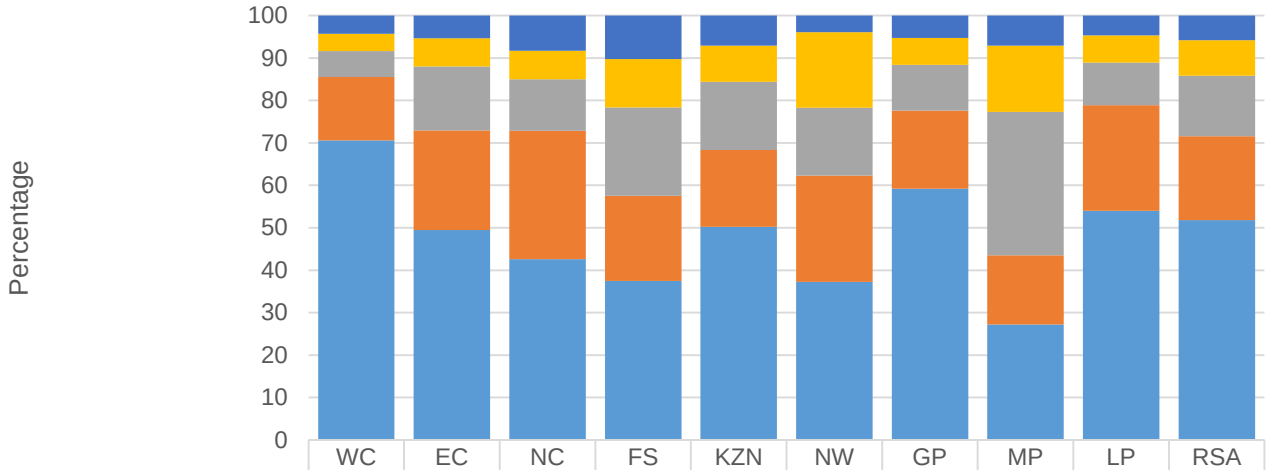
5.4.1 Aggregate number of perceived environmental problems by geographical characteristics

Table 5.5 and Figure 5.8 shows that, nationally, less than half of all households experienced one or more environmental problem. Large variation is, however, noted across provinces. Nearly half of the households surveyed during 2016 reported perceiving at least one environmental problem. Households in Western Cape (70,6%) and Gauteng (59,2) experienced the least environmental problems, whilst households that lived in Mpumalanga (27,2%), North West (37,3%) and Free state (37,5%) reported highest environmental problems experienced. A tenth of households in Free state experienced, water pollution, air pollution, littering and land degradation followed by 8,4 per cent of households living in Mpumalanga and KwaZulu-Natal. A quarter of households that lived in North West and Limpopo experienced at least one of the four problems whilst the highest percentages were reported in Northern Cape (30%). The measurement of exposure to multiple environmental problems might provide insight into the nature of households' exposure to their immediate environments

Table 5.5: Percentage of households who experience environmental problems by province, 2016

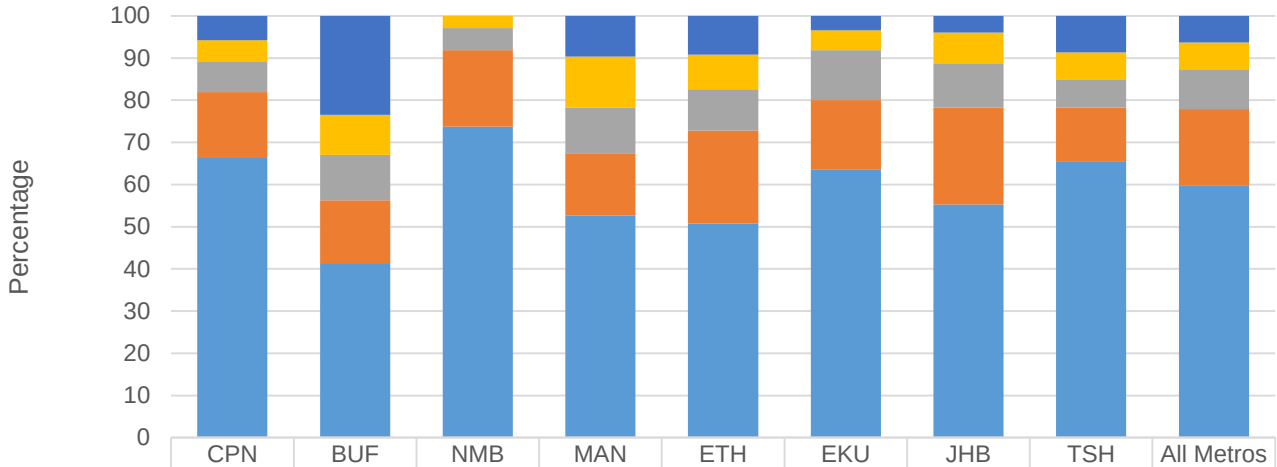
	No problem experienced	1 Problem experienced	2 Problems experienced	3 Problems experienced	4 Problems experienced
Western Cape	70,6	14,9	6,2	4,0	4,3
Eastern Cape	49,4	23,5	15,1	6,6	5,4
Northern Cape	42,6	30,3	12,2	6,7	8,3
Free State	37,5	20,1	20,8	11,4	10,3
KwaZulu-Natal	50,2	18,1	16,1	8,5	7,1
North West	37,3	25,1	15,9	17,8	3,9
Gauteng	59,2	18,5	10,7	6,3	5,3
Mpumalanga	27,2	16,3	33,7	15,6	7,1
Limpopo	54,0	24,9	10,1	6,4	4,7
South Africa	51,8	19,8	14,3	8,3	5,8

Figure 5.8: Percentage of households who perceived environmental problems by province, 2016



	WC	EC	NC	FS	KZN	NW	GP	MP	LP	RSA
4 Problems experienced	4,3	5,4	8,3	10,3	7,1	3,9	5,3	7,1	4,7	5,8
3 Problems experienced	4,0	6,6	6,7	11,4	8,5	17,8	6,3	15,6	6,4	8,3
2 Problems experienced	6,2	15,1	12,2	20,8	16,1	15,9	10,7	33,7	10,1	14,3
1 Problem experienced	14,9	23,5	30,3	20,1	18,1	25,1	18,5	16,3	24,9	19,8
No problem experienced	70,6	49,4	42,6	37,5	50,2	37,3	59,2	27,2	54,0	51,8

Figure 5.9: Percentage of households who experience 4 environmental problems by metro, 2016



	CPN	BUF	NMB	MAN	ETH	EKU	JHB	TSH	All Metros
4 Problems	5,8	23,5	0,0	9,7	9,2	3,5	4,0	8,7	6,3
3 Problems	5,1	9,5	2,9	12,1	8,2	4,7	7,3	6,4	6,5
2 Problems	7,2	10,8	5,2	11,0	9,8	11,9	10,5	6,6	9,3
1 Problem	15,4	14,9	18,2	14,6	22,1	16,4	23,0	12,9	18,1
No problem	66,5	41,4	73,7	52,7	50,7	63,6	55,3	65,4	59,8

Nearly a quarter (23,5%) of households that resided in Buffalo city experienced all the four environmental problems, followed by 9,7% of households in Mangaung and 9,2% in eThekwini. Only 6,3% of households in the metros as a whole experienced all four environmental problems. This is presented in figure 5.9. The figure also shows that perceived environmental problems were least common in Nelson Mandela Bay where 73,7% of households reported no problems, followed by Cape Town (66,5%) and Tshwane (65,4%). In contrast, 43,7% of households in Buffalo city experienced more than two environmental problems, followed by eThekwini (27,2%). In fact, 22,1% of households across all metros experienced more than one environmental problem.

Figure 5.10: Percentage of households who experience environmental problems by geotype, 2016

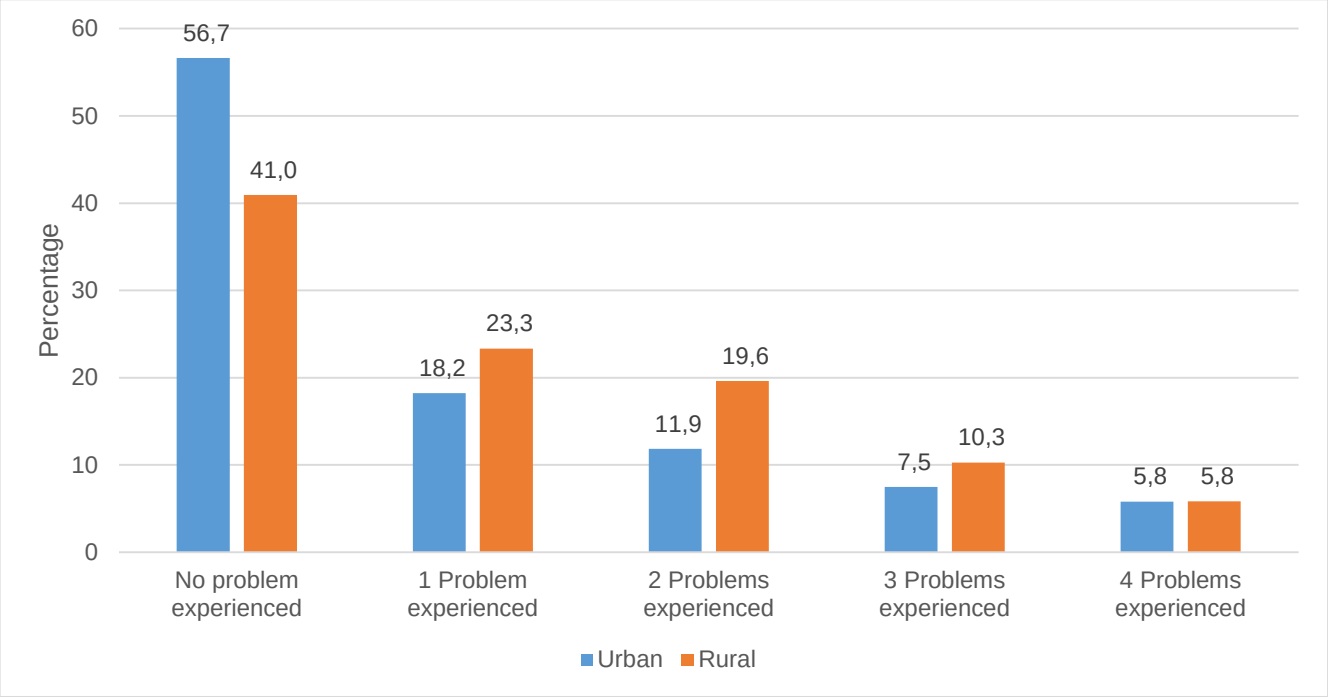
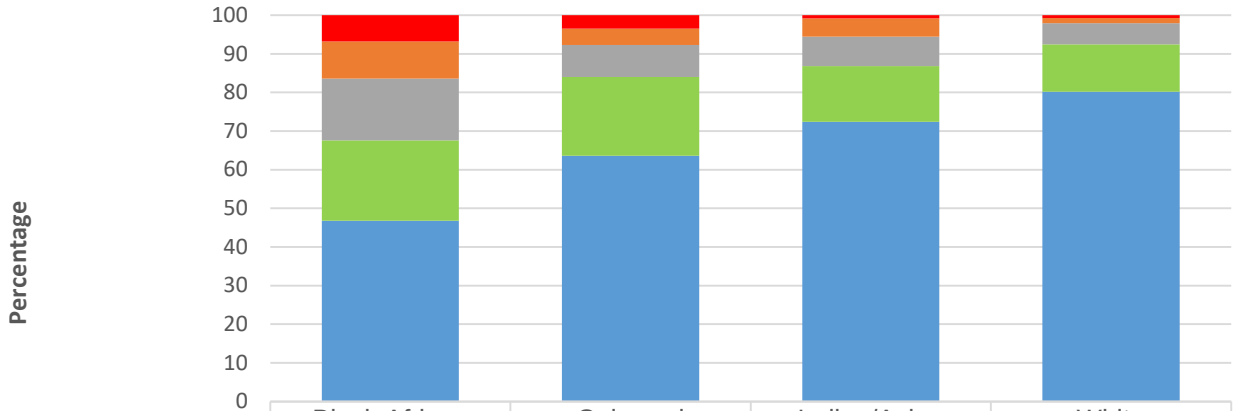


Figure 5.10 depicts percentages of households who experienced environmental problems by geotype. There seem to be no pattern as far as households that experienced 4 environmental problems than both rural and urban areas reported 5.8 per cent.

5.4.2 Aggregate number of perceived environmental problems by socio-economic characteristics

This text has already highlighted the positive association between socio-economic and demographic factors and the experiences of environmental problems. Studies show that individual and societal environmental perceptions are diverse, interrelated and closely tied to social concerns (Hunter et al, 2010). Figure 5.11 outlines households' experiences of environmental problems in terms of the population group of the household head.

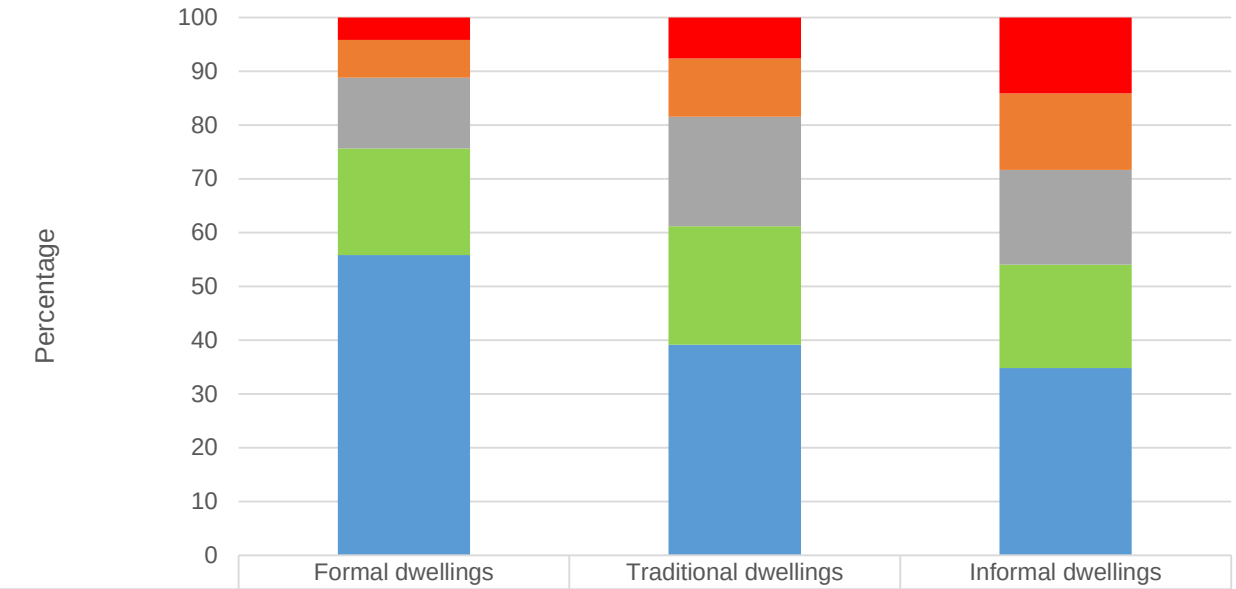
Figure 5.11: Percentage of households who experience environmental problems by population group of the head of the household, 2016



	Black African	Coloured	Indian/Asian	White
4 Problems experienced	6,8	3,4	0,8	0,7
3 Problems experienced	9,6	4,3	4,7	1,4
2 Problems experienced	16,0	8,2	7,6	5,4
1 Problem experienced	20,8	20,4	14,4	12,3
No problem experienced	46,8	63,6	72,4	80,2

Figure 5.11 show that households headed by Black Africans were most likely to have experienced at least one environmental problem (53,2%), followed by households headed by coloureds (36,4%), then households headed by Indian/Asian (27,6%) and households headed by whites (19,8%). A third (32,4%) of households headed by Black Africans reported experiencing two or more environmental problems compared to only 15,9% of households headed by Coloureds.

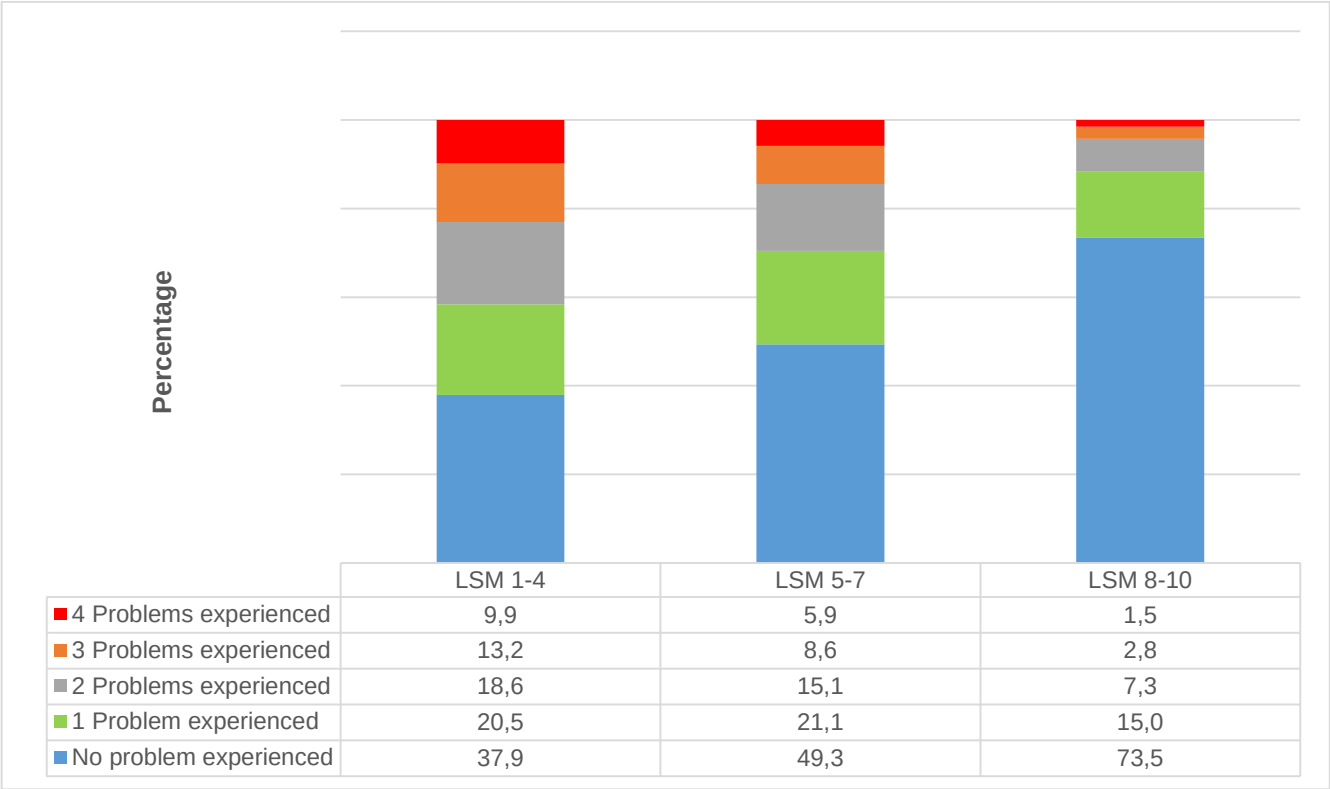
Figure 5.12: Percentage of households who experience environmental problems by dwelling type, 2016



	Formal dwellings	Traditional dwellings	Informal dwellings
4 Problems experienced	4,1	7,6	14,1
3 Problems experienced	7,1	10,8	14,2
2 Problems experienced	13,1	20,4	17,6
1 Problem experienced	19,8	22,0	19,2
No problem experienced	55,8	39,2	34,9

Nearly three-tenths of households that lived in informal dwellings experienced three or more environmental problems compared to 18,4 and 11,2 per cent of households living in traditional and formal dwellings respectively. Slightly over a third of households living in informal dwellings did not experience any environmental problem and this figure stood at 55,8% for households living in formal dwellings. This is presented in figure 5.12.

Figure 5.13: Percentage of households who experience environmental problems by living standard measure, 2016



	LSM 1-4	LSM 5-7	LSM 8-10
4 Problems experienced	9,9	5,9	1,5
3 Problems experienced	13,2	8,6	2,8
2 Problems experienced	18,6	15,1	7,3
1 Problem experienced	20,5	21,1	15,0
No problem experienced	37,9	49,3	73,5

Figure 5.13 indicates that households categorised as Low LSM were most likely to have experienced one or more environmental problem. Experiencing one or more environmental problems becomes less common in each successive LSM category.

A logistic regression model was run for the four environmental problems above as the dependent variable was dichotomous in nature. However, combining these four environmental problems means that the categorical data is no longer binary as the household can experience multiple problems. In this instance, the logistic regression will be invalid hence multiple or multinomial logistic regression will be best. Multinomial logistic regression is a simple extension of binary logistic regression that allows for more than two categories of the dependent or outcome variable. Like binary logistic regression, multinomial logistic regression uses maximum likelihood estimation or and odds ratio to evaluate the probability of categorical membership. A combination of the four environmental problems make it possible for households not to experience an environment problem or at worst experience all the four problems. Households can also experience one or two or three of the four problems. This has resulted in a dependent variable with five categories, which were then reduced to three in order to eliminate complexity during the interpretation stage. The three categories were as follows; households did not experience any environmental problem (0), households experienced at most two problems (1) and lastly households experienced at least three environmental problems (2).

The probability model was that households experienced at most two problems against not experience of environmental problems and those that experienced at least 3 problems.

Table 5.6: Predictors of households experience environmental problems using multiple logistic regression, 2016

Probability modelled	Households experienced at most two environmental problems
Likelihood ratio chi-square	19 793
Hosmer and Lemeshow goodness of fit test (P-value)	0,0001
N	16 662 069
Intercept (1)	2,039
Intercept (2)	-2,5162

Odds ratio			
Province		**Living Standard Measure**	
Western Cape (reference category)		LSM 8-10 (reference category)	
Eastern Cape (1)	0,543	LSM 1-4 (1)	0,791
Eastern Cape (2)	0,766*	LSM 1-4 (2)	2,149
Northern Cape (1)	0,38	LSM 5-7 (1)	0,79
Northern Cape (2)	1,277*	LSM 5-7 (2)	1,436
Free State (1)	0,324	**Population Group of the head of the household**	
Free State (2)	1,368*	White (reference category)	
KwaZulu-Natal (1)	0,586	Black African (1)	0,523
KwaZulu-Natal (2)	1,169*	Black African (2)	2,422
North West (1)	0,397	Coloured (1)	0,522
North West (2)	1,622	Coloured (2)	1,466*
Gauteng (1)	0,589	Indian / Asian (1)	0,769*
Gauteng (2)	0,729*	Indian / Asian (2)	1,23*
Mpumalanga (1)	0,227	Income quintile	
Mpumalanga (2)	1,511	Wealthiest quintile (reference category)	
Limpopo (1)	0,774*	Poorest quintile (1)	0,785
Limpopo (2)	1,056	Poorest Quintile (2)	1,25
Geographical location		Quintile 2 (1)	0,758
Urban (reference category)		Quintile 2 (2)	1,126*
Rural (1)	0,703	Quintile 3 (1)	0,865
Rural (2)	0,736	Quintile 3 (2)	1,223
Dwelling Type		Quintile 4 (1)	0,915*
Formal (reference category)		Quintile 4 (2)	0,946*
Traditional (1)	0,905*		
Traditional (2)	1,183*		
Informal (1)	0,576		
Informal (2)	1,693		
Metropolitan Municipality			
Households not living in Metropolitan municipality (reference category)			
Households living in Metropolitan Municipality (1)	1,159*		
Households living in Metropolitan Municipality (2)	1,659		

* Insignificant values at 95%.

The results of table 5.6 show that the odds of households that lived in the other eight provinces were smaller than the odds of households that lived in Western Cape not to have experienced any environmental problems as compared to experiencing two problems at most. When looking at the odds of experiencing at least three environmental problems than experiencing at most two problems the odds of households in the eight provinces were larger than the odds of households living in Western Cape, however, the difference for Gauteng was insignificant. The odds of households that lived in rural areas were 0,703 and 0,736 times less than the odds of households living urban areas not to experience any environmental problems and to experience at least two environmental problems respectively than to experience at most two problems. Analysis of dwelling type show that households that lived in traditional dwellings and informal dwellings were less likely not to experience any environmental problem than experiencing at most two problems, however, the opposite was true for experiencing 3 or 4 environmental problems. Similar trends to those of provinces and dwelling types were observed for income quintile, population group of the head of the household and analysis of Living Standard measure.

5.5 Summary and conclusions

Nationally, households' experiences of land degradation, excessive littering, water pollution and air pollution have started to diverge over time. Since 2009, perceived problems with land degradation and littering have become more pronounced vis-à-vis water and air pollution. The section shows that household perceptions of particular environmental conditions are closely related to particular household characteristics. Households headed by whites or that were categories as LSM 8-10 households were least likely to have experienced any environmental problems, while households headed by black Africans or with low standards of living (LSM 1-4) were most likely to have perceived one or more environmental condition. Similarly, households living in urban areas were less likely to have experienced land degradation, probably because they are not depending on the land around them as much as rural households do. From a provincial point of view, households that lived in Western Cape are least likely to experience any environmental conditions.

It is clear that environmental perceptions are not homogenous across geographic space or between households with different characteristics. Understanding local perceptions is a vital first step to mitigating local environmental concerns. Since environmental concerns are closely linked to individual household experiences and characteristics, it should come as no surprise that many environmental concerns are shared across geographic areas, be it at different levels of intensity.

Two limitations are identified. Questions were firstly asked at household level of largely unidentified proxy respondents. Since perceptions are very personal, the characteristics of the respondent potentially had a significant impact on the household's perception. Related to the first point, households were also not asked to explain why they held particular environmental perceptions. Environmental concerns are multidimensional and it may be important to assess the relative importance of the composite reasons. Another concern is that data can only be reported as provincial or metropolitan levels, meaning that data on the local environmental conditions cannot be viewed as a finely grained mesh. Despite these limitations, data from the GHS provide a valuable source of information to identify local environmental conditions based on individual household experiences.

The results of this study show that general awareness of environmental conditions is associated with households' socio-economic and demographic characteristics. More research, however, needs to be done to establish if awareness will change as households' socio-economic conditions change. To achieve the greatest possible benefit from this data, it is important that responses to local community environmental conditions are disaggregated at sub-provincial levels as this would create a more nuanced view of the underlying environmental conditions to be addressed.

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7 Appendix

7.1 Reclassification of dwelling types

New Category	Original dwelling type used in the GHS
Detached single-unit housing	1 = Dwelling/house on separate yard/stand 4 = cluster house in complex
Semi-detached dwellings	5 = Town house / Semi-detached house in complex 6 = Semi-detached house
Attached multi-unit housing (Flat or apartment)	3 = Flat or apartment in a block of flats
Dwelling/room/flat in backyard	7 = Dwelling/house/flat/room in backyard 10 = Rooms/flatlet on a property or a larger dwelling/servant's quarters/granny flat/cottage
Informal backyard	8 = Informal dwelling in backyard
Informal dwelling	9 = Informal dwelling not in backyard 2 = Traditional dwelling
Other	11 = Caravan/tent 12 = Other

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