

Roslyn Associates

the **Waste Away Scheme** **Phase Two:**



*a quantitative survey of the
effectiveness of The Moray Council's
waste minimisation scheme to reduce
organic kitchen food waste going to
landfill.*

funded by Landfill Tax Credits from The Moray Council

Commissioned by



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ECOLINC is an independent voluntary organisation which encourages environmental education and promotes local practical environmental projects. An annually elected co-ordinating committee has carried out work in the following areas:

- ✓ Environmental Education – ECOLINC organises an annual environmental quiz for school children. The venue for this event moves to different schools around north-east Scotland.
- ✓ Air Quality surveys – 3 different surveys have been organised to assess the air quality across the north-east of Scotland. Sycamore leaves on trees and lichens were used as biological indicators. One survey was carried out along the main A96 Aberdeen Inverness Road.
- ✓ Coastwatch survey – ECOLINC played a major part in the Norwich Union Coastwatch survey which ran for 6 years in the early 1990s. The aim was to quantify and identify the types of waste found in order to determine its source.
- ✓ Organic farming – Over the years ECOLINC has undertaken considerable research on this topic. Activities include hosting and organising an all-day seminar, a debate on genetic modification, networking with organic growers, organised farm visits and research into the Green Cone and composting methods. ECOLINC produces an Organic Growers and Suppliers List which is regularly updated for the north east of Scotland.
- ✓ Other projects tackled include water analysis, recycling and a one-day seminar on sustainable transport.

New members are welcome at any time. Please see the accompanying application form or visit our website at www.ecolinc.org.uk

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The Waste Away Scheme Phase 2:

A quantitative survey of the effectiveness of The Moray Council's waste minimisation scheme to reduce organic kitchen food waste going to landfill.

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The Waste Away Scheme

Phase 2: Summary

A quantitative survey of the effectiveness of The Moray Council's waste minimisation scheme to reduce organic kitchen food waste going to landfill.

Aim and objectives

- Measure the amount of organic kitchen food waste going to the Green Cones in Moray, during a 12-week period, using 63 volunteer households.
- Calculate the average weekly weight of organic kitchen food waste and thus calculate the amount that is potentially being recovered and diverted from landfill by current Moray Council's Waste Away scheme.
- Using the data, assess if the Waste Away scheme can meet the landfill directive targets for recovery of biodegradable municipal waste (BMW).

Participation rate: between December 2001-February 2002 was 94%

Key findings statistics and comments

Households in Moray produce 2.91kg organic kitchen food waste per week as a mean average. The average household could therefore divert 151kg organic kitchen food waste per year from landfill to the Green Cone based on the results of this research project.

The data in this report should aid The Moray Council in their waste strategy since they now have reliable figures on which to base a strategy for the diversion of organic kitchen food waste from landfill.

The Babbie Group have indicated they will use this data in the final implementation plan of the overall waste management in Moray.

The Moray Council needs to divert 7217.5 tonnes of BMW in order to reach the landfill directive target. If all households in Moray had a Green Cone (an unrealistic target) then the amount of BMW diverted would be 83% of the required 7217.5 tonnes. The Moray Council could not therefore meet the landfill directive requirement solely by diverting organic kitchen food waste from all households. However utilising Green Cones as part of an overall strategy is quite feasible.

With the results of this research project The Moray Council could argue that they are already reducing biodegradable waste placed in landfill by 1% of the 1995 levels (purely based on the 1100 Green Cones already in Moray diverting a total of 166 tonnes).

The Moray Councils current strategy is that 40% of households will be engaged in home composting (including Green Cones). If this target is reached based solely on the use of Green

Cones then 2402 tonnes of organic kitchen food waste could be removed per year which is 9% of the total 28,000 tonnes domestic waste stream and 33% of the 7217.5 tonne directive target.

The lifestyle questionnaire data indicates the potential for the existing Green Cone users (some of whom have had their Green Cone for between 6-10 years [1]) to divert their meat, fish, plate scraps, dairy, fruit and bread etc. waste **from** the wheelie bin **to** the Green Cone. An educational programme (e.g. video) could be used to ensure the unit is reaching its full potential. Unexpectedly up to 35% of the 63 household participants are diverting meat, fish and dairy product waste to pets, birds and other animals. Between 40-50% of household participants diverted their bread/cake and milk waste to pets, birds and other animals, (Pet waste can go to the Green Cone).

A common misconception of householders was evident as to the amount of organic kitchen food waste they actually produce. Prior to starting the weighing programme 66% of households underestimated how much they would actually put in the Green Cone.

If the Waste Away scheme is extended and for the 40% home composting strategy to be achieved, in partial fulfilment of the landfill directive target, then it is essential that new Green Cones are placed in suitable households. General profiles are suggested for *Green Cone*, *Green Cone/Compost unit households* and *Compost unit only households*. Use of a questionnaire is recommended ensuring that households are issued with a unit that addresses their needs, in order that public money is not wasted.

ECOLINC have indicated that they would be pleased to be involved in expanding the scheme further, and would apply for Landfill Tax funding to achieve this aim, if this was applicable.

The results (when combined with the research results from Waste Away Phase 1 [1]) could be used to support an expansion of the current Waste Away scheme to those areas outwith the centralised composting catchment area. In the light of the government policy and legislation, it is recommended that the opportunity, political will and necessary finance to expand the Waste Away Scheme to other areas of Moray should be sought.

Action Points suggested by the research results (marked ✂ AP in the report)

✂ **AP (Page 19)** There is a good reason for an educational programme to be formulated for all those people who currently have a Green Cone, this could take the form of a video or educational pack. This educational information could then be distributed with all new Green Cones and be incorporated into the cost of them so as to ensure that the full potential of diversion of organic kitchen food waste from the wheelie bin to the Green Cone is reached.

✂ **AP (Page 22) - 2402 tonnes of organic kitchen food waste could be removed per year** at a disposal cost of £44/tonne, **£106,000 per year could be saved.** This money could be diverted to pay for capital costs of the required Green Cones and/or home composting units.

✂ **AP (Page 26)** ..There are a number of reports and studies which have been located that are either ongoing or about to be published and when they are available there maybe interesting comparisons with the results of Waste Away Phase 2.

✂ **AP (Page 27)** Roslyn Associates would recommend that a questionnaire is filled in by all householders (the questionnaire could incorporate the Lifestyle questions from this report) prior to issuing them with either a Green Cone or a home composting unit. This is in order to more correctly assess their needs. This should help to alleviate public money being misdirected

✂ **AP (Page 27)** Tucker [35] has developed a model framework for predicting home composting behaviours within the context of integrated household waste management. It would be interesting to see how the model coped with an input of the Waste Away Phase 2 data for organic kitchen food waste (i.e. compostable and non-compostable) going to a Green Cone. This could be followed up by The Moray Council or Green Cone Ltd.

✂ **AP (Page 28)** For fulfilment of the strategy - 40% of households in Moray to be home composting - it would be sensible to find out by questionnaire how many households are currently composting as these could then be discounted from the 40% target.

✂ **AP (Page 28)** In order to reach the landfill directive targets care must be taken to target those households that are not already engaged in composting since it could be more effective to direct resources at these households.

✂ **AP (Page 28)** Once new households are brought into the Waste Away scheme then weight measurements could be estimated from weight decreases logged from collection round data and landfill gate weight data.

✂ **AP (Page 28)** If compost bins are also issued then previous work by other councils, such as Cambridgeshire County Council (issued over 40,000 subsidised compost bins), could be looked at and their experience utilised.

✂ **AP (Page 28)** The Moray Council, through one of the national bodies could perhaps obtain information on home composting research from other local authorities.

✂ **AP (Page 28)** The Green Cone is suitable for both large and small gardens, and even those with patios, provided the cone can be dug into the ground. If however Home Compost units are also required for 40% of households as per the strategy then it may be useful to assess the number of gardens which have vegetative cover. The current estimate is that 90% of households in Moray have gardens [19]. In order to accurately assess the size of gardens, G.I.S. products such as *MasterMap*, or high resolution satellite images to assess vegetative cover (with an infra-red spectrum for the two main seasons of the year) could be used. These would enable the current estimate figure to be proved.

1. Introduction, Aims and objectives of the Waste Away Phase 2 research

Aim of the Waste Away Phase 2 research project

Measure the amount of organic kitchen food waste going to the Green Cones in Moray, during a 12-week period using volunteer households.

Objectives

1. Calculate the average weekly weight of organic kitchen food waste and thus calculate the amount that is potentially being recovered and diverted from landfill by current Moray Council's Waste Away scheme.
2. Using the data, assess if the Waste Away scheme can meet the landfill directive targets for recovery of biodegradable waste.

Potential Outcomes

Environmental Services at The Moray Council should be able to assess the benefits of the current Waste Away Scheme in terms of the amount of waste recovered for relatively rural areas and utilise this information in the implementation of the current waste strategy.

The Moray Council will have reliable information that could aid decision making on extending the current Waste Away Scheme (when combined with the research results already obtained by ECOLINC [1]).

Why Is Biodegradable Waste Minimisation, Recovery or Treatment Important?

There are a number of important reasons why it is necessary for local authorities to consider recovery of biodegradable waste that includes green garden waste, organic kitchen food waste and waste paper or the introduction of practices to minimise the waste source. Successful organic waste minimisation and recycling at source have the potential to significantly decrease the amount of waste going into the waste stream, reduce direct transportation costs by fuel savings and indirectly reduce the cost to the environment. Such schemes can also raise public awareness of the concept of waste minimisation and provide them with a free fertiliser for the garden.

1. The amount of organic waste produced:

It is important to deal with organic waste as close to source as possible since it forms a significant part of the 2.4 million tonnes per annum of household and civic amenity waste produced overall in Scotland [2]. The estimated total annual waste arising in the U.K. for households (including civic amenity input) is 20 million tonnes [3]. According to the Scottish Office, 26% (by weight) of the household waste produced is putrescible and will therefore biodegrade [4]. Although the percentage figure is comparatively low, because of the nature of the waste and its high contamination potential in terms of other recyclables in the wheelie bin, there is an argument for increasing the loading attached to the 26% due to the noxious nature of the waste. Peter Harper of CAT (Centre for Alternative Technology) has argued the organic fraction (including paper and cardboard) amounts to between 50-80% [5]. Other researchers have shown that putrescibles (kitchen and garden) vary between 30% in winter to 52% in summer [6]. There may however be a flaw in all waste audits of wheelie bin contents where the waste is weighed. There are significant amounts of moisture in for example organic kitchen food waste. Some of this maybe transferred to other recyclables and therefore the actual amount of organic kitchen food waste measured could be underestimated. Weighing organic kitchen food waste at source (prior to it being put to a Green Cone) which is the purpose of the Waste Away Phase 2 research should provide more accurate figures than the traditional waste audit approach.

2. Climate change:

Degradation of waste by microorganisms produces Greenhouse gases such as methane. Whilst methane levels in landfill can be high, measurements of methane in compost bins were found to be

negligible or very low depending on the time of year [7]. In terms of climate change it would appear preferable for elements of biodegradable waste to be dealt with by the householder utilising either a composter or Green Cone rather than the waste going directly to landfill.

3. Legislation and enforcement agency drivers:

Last year according to the Accounts Commission for Scotland [8] only 6.9% of household waste was recycled compared with countries such as Switzerland which recycles 52%, Netherlands (45%), Austria (45%) and Norway (34%). Seven councils (Aberdeenshire, Angus, Argyll and Bute, Orkney, Perth and Kinross, Scottish Borders and Shetland) recycled more than 10% of waste an increase from the 6% the previous year. However 14 councils recycled less than 5% of their household waste last year.

The EU Landfill Directive (99/31/EC), which came into effect on 16 July 2001, requires a reduction of biodegradable waste placed in landfill to 75% of the 1995 levels by 2006, 50% by 2009 and 35% by 2016. The Directive requires local authorities to remove 450,000 to 600,000 tonnes per annum by the year 2006. This compulsory target is Scotland-wide though the Scottish Executive has permission to extend the first target to the year 2010 [9]. After this date the penalties and sanctions for non-compliance would be inevitable from the European court.

To reach 75% of the 1995 levels by 2010, the whole of the North East of Scotland (Aberdeen City, Aberdeenshire and Moray) will need to divert 49,024 tonnes of biodegradable municipal waste (BMW) from landfill. The definition of BMW is food, paper, wood and other wastes that decompose from household or commercial premises. The National Waste Strategy for the NE includes 5 indicative options all produced by WISARD lifecycle assessment software. In terms of the amount of waste to be diverted for composting generally, the amount ranges from 20,000 tonnes to 60,000 tonnes depending on the indicative option [10].

SEPA is encouraging local authorities to think seriously about waste minimisation procedures rather than waste management facilities, since they suggest that procedures would be more cost effective in the long-term [8]. Under the Waste Minimisation Act, 1998, local authorities also have powers to address the minimisation of waste in their areas [8].

Other drivers include the Kyoto Protocol, Local Agenda 21, the Proximity Principle, new EC policy (e.g. Biowaste Directive and Soil Strategy) and sustainability issues e.g. closing the 'organics' loop.

4. The Moray Council's own policies:

The Moray Council's interest in organic waste minimisation: the Waste Away Scheme was initiated in 1992 as a pro-active attempt by The Moray Council to comply with the U.K. policy encouraging local authorities to recycle or compost 25% of household waste by the year 2000.

Moray District Council produced a Recycling Plan in 1994 which stated that "the separation of compostable materials, as one of the largest components of domestic waste, must be seen as an area of waste minimisation to be concentrated on in a rural area such as Moray, particularly with its related benefits of reduction in landfill gas emissions....." [11]. The integrated draft waste strategy for Moray produced in May 2000 [12] highlights "promoting Waste Minimisation (e.g. Home Composting)" as part of the overall strategy. The Moray Council has produced an Environmental Charter. This was made in relation to a number of principles which include "Minimise Waste".

Environmental Services at The Moray Council can only estimate figures for amount of green garden waste recovered by households with a Green Cone and the assumption has been made that each household would recover 13% of their total waste (i.e. 66% of their green waste) to the Green Cone. Currently there is a lack of hard data to support the estimated figure of 13% for organic waste recovery by households with a Green Cone [Appendix 1]. The figure of 13% was derived when it was assumed that Green Cones were taking green garden waste as well as organic kitchen food waste. All householders have since been advised not to put green garden waste into the Green Cone. Thus the research proposal for Waste Away Phase 2 concentrated on measuring organic kitchen food waste rather than garden green waste or paper.

2. Background to the Waste Away Phase 2 research project

In the year 2000 ECOLINC commissioned Roslyn Associates to carry out research to ascertain the householders' general satisfaction with the Green Cone, used in The Moray Council's organic waste minimisation project - The Waste Away Scheme. This was the Waste Away Phase 1 research [1]. The Waste Away Phase 1 research was funded by landfill tax credits from The Moray Council. A presentation of the results was given to The Moray Council in November 2000. The findings were published in a report [1], which is available as hard copy either from ECOLINC/through the Library Lending system or can be downloaded for free from www.ecolinc.org.uk/.

Waste Away Phase 1 also examined the user's perception of the effectiveness of the Green Cone used in the Waste Away Scheme. The objective was to quantify the positive and negative aspects of the scheme by carrying out a questionnaire survey of households who had participated in the scheme during the time period 1992-2000. The Moray Council's Waste Away Scheme can be deemed to be a success in so far as 76% of respondents are generally satisfied with their Green Cone and wish to continue in the scheme.

The questionnaire response rate was 32%. The total number of Green Cones issued in Moray is 1100 however The Moray Council database only has 863 household details.

The results were encouraging and could be used to support a call for expansion of the Waste Away Scheme into areas outwith the new centralised composting scheme being piloted by The Moray Council. The report [1] concluded that an expanded Waste Away Scheme could complement the current pilot centralised composting scheme¹ and could include home composting units if individual householders require an alternative to the Green Cone.

During the course of the research for Waste Away Phase 1 [1] ECOLINC became interested in helping to extend the current Waste Away Scheme to more households in Moray. However to justify the extension it was agreed that more research was required on the amount of waste currently being accounted for by the scheme which would otherwise have gone to the Dalloch landfill site². There was no specific data or statistics available on organic kitchen food waste going to the Green Cones in Moray. (There is a general absence of published statistics on the amount of materials composted at home [13]). Without this data it would be impossible to prove the effectiveness of either the current scheme or an expanded scheme in terms of waste recovery.

Green Cone Ltd showed an interest in the completed research from Waste Away Phase 1. Discussions followed on from this and subsequently Green Cone Ltd worked with Dr Melanie Jones of Roslyn Associates. The outcome of these discussions was a colour leaflet (modified specifically for those Moray householders with a Green Cone) to provide updated essential information on the correct use of the Green Cone (Appendix 2). The colour leaflet was printed by Green Cone Ltd. Roslyn Associates produced a letter summarising the main results of the Waste Away research project (Appendix 3) and these two documents were posted out by The Moray Council to the 863 householders on their database who had the Green Cone. The Waste Away research project Phase 1, therefore accrued more value and extended far beyond its original remit.

In preparation for the Waste Away Phase 2 proposal for landfill tax credits from The Moray Council, a call for volunteers was inserted with the letter and leaflet shown in Appendix 2 and 3. Volunteers were asked to reply to Roslyn Associates if they were interested in taking part in a three-month research project. The survey would measure the amount of waste the Green Cone takes from their household. This 'call' gathered 35 potential volunteer households.

¹ The centralised composting scheme involves householders and commercial enterprises taking their green waste to a civic amenity site from whence it is collected by a local farmer for composting. In 2001/2 1884 tonnes was collected and in 2000/1 715 tonnes were collected.

² Dalloch landfill site takes all the municipal solid waste (MSW) collected in Moray. The site opened in 1993 and has capacity for another 10-15 years depending on rate of disposal.

The research quota required for Waste Away Phase 2 was a minimum of 50 volunteer households. This was calculated on the requirement to obtain a large enough sample size (within 95% confidence limits) of the total 863 households with Green Cones still available on Moray Council's database.

The project required 15 new Green Cones to fulfil the target and therefore negotiations were undertaken with Green Cone Ltd. They agreed to supply 15 additional new Green Cones free of charge should 15 new volunteers be required to make up the total number of participants for the Waste Away Phase 2 research project.

Green Cone Ltd also agreed to provide the 50 volunteer households with:

1. a free kitchen caddy to carry food waste from the kitchen to the Green Cone
2. a free accelerator shaker to hold the accelerator powder
3. a supply of accelerator powder for a 3 month period
4. £50 cash prize for a prize draw to encourage involvement and enhance participation for the full 12 weeks data collection period

The proposal for Waste Away Phase 2 was accepted by Entrust and awarded to ECOLINC in September 2001. Roslyn Associates was commissioned on 15th October 2002 to undertake the research, write the research report and report the results in a verbal presentation to The Moray Council by 14th July 2002.

3. What is the Green Cone?

According to the manufacturer [14] the Green Cone food waste digester is the only designed and proven unit to aid in the elimination of household waste at source. The unit aims to eliminate the whole putrescible fraction in cooked foods, fish, meat, bread, bones and soft raw vegetable waste.

According to the Green Cone web page [15], there are various advantages to using the Green Cone such as:

- easy to use, just fill and forget
- no skill or effort required
- takes all smelly food waste
- keeps wheelie bins clean
- encourages recycling at home
- use every day, - empty every year or two
- solar powered
- reduces landfill pollution

The Green Cone is a four part injection moulded unit comprising a lower basket installed below ground and an upper assembly consisting of an inner and outer lidded plastic cone, which stands 75cm above the ground. The unit requires no maintenance and only requires emptying every two years.

How does the Green Cone work?

The Green Cone System has been designed to ensure that air constantly flows through the waste in the digestive chamber, thereby facilitating the growth of microorganisms. The waste material is rapidly converted into H₂O, CO₂, and the minimal residue is attenuated into the surrounding soil. The unit utilises solar energy to promote positive pressure air circulation, producing enhanced dehydration and aerobic digestion processes. According to the manufacturer, used properly it does not smell or pollute the water table and does not produce methane [15].



Figure 1. Diagram from the Green Cone Web site

Product Re-Launch

Since the original Waste Away Scheme report [1] was written, the Green Cone company has re-launched itself. The Green Cone is now marketed together with the following new items [15].

1. A kitchen caddy - 4.5 litre capacity and has an activated carbon filter in the lid. Provides a convenient/easy way to deposit organic food waste into the Green Cone. Kitchen waste is placed into the caddy and then emptied into the Green Cone on a daily basis.
2. A kitchen shaker - contains the green cone accelerator powder. It is recommended that the shaker is used every day by shaking a couple of times over the waste in the caddy before emptying into the cone. Previously the powder had to be made up with water and added direct to the cone. This process has now been greatly simplified.

The need to apply accelerator.

It is necessary to start the decomposition process by using an accelerator. This substance contains a blend of mesophile bacteria, efficient at temperatures up to 45°C and thermophile bacteria, efficient at temperatures up to 70°C. The bacteria produce 4 principal types of organisms: lipases (digest fats), amylases (digest carbohydrates), proteases (digest proteins) and cellulases (digest cellulose). These enzymes allow the bacteria to absorb the waste as food and convert it to carbon dioxide and water. During the early stages of the decomposition process, food waste is colonised by the mesophiles. When the thermophiles become dominant, the result is the production of heat. At these higher temperatures, biodegradation of the more complex organic materials occurs along with pasteurisation. When their food source becomes exhausted, the thermophiles slow down and the temperature drops, causing some of the remaining mesophile bacteria to reactivate and continue the process of degradation. However, at this point they need replenishing by the addition of more accelerator [16]. The manufacturer recommends that the accelerator is added with the first organic loading to start the break down process and then **repeated when the kitchen caddy is full** so that the mesophile bacteria in particular can be replenished to cope with new loads of food waste. Regular dosing also has beneficial effects in terms of reducing the nuisance from flies, by eliminating odours and accelerating the degradation process. [15]. Rates of decomposition can vary depending on material, ambient temperature and presence of efficient micro-organisms. **Even in winter the accelerator can speed up decomposition** [15].

If flies become a nuisance, the manufacturers suggest that the green cone accelerator is not being used correctly. In the event that a fly problem should occur, they recommend that a household fly killer be hung from the inner part of the cone. The use of a chemical activator in the Green Cone is not recommended as it may cause toxic build up. Similarly, the addition of household disinfectants, bleaches or cooking oil will stop it working [15].

The Green Cone Process in comparison to conventional composting

Compost is essentially the product of the breakdown of organic material. A greater variety of micro-organisms are involved in composting compared to the Green Cone process. Composting requires the addition of oxygen at the right time usually through the physical turning of the material. If oxygen is unable to enter the compost (through turning), the material in a compost heap becomes anaerobic and begins an alternative process of decomposition, breaking down through putrefaction. In contrast, the Green Cone can be "filled and forgotten", provided the accelerator is applied when the Kitchen Caddy is full. The Green Cone manufacturer claims the cone's process is aerobic, utilising solar energy to promote positive pressure oxygen circulation which leads to enhanced dehydration and aerobic digestion processes [15]. The digestion chamber of the Green Cone where the waste matter decays, is below ground level and thus there are no smells associated with rotting food, etc. Furthermore the design of the Green Cone results in far higher temperatures being generated with the associated increase in bacteria activity. Thus the Green Cone can break down products, such as bones, very much faster than in the traditional compost heap [15]. The composting process produces 'compost' which resembles soil and acts as a well mixed, balanced soil conditioner [17]. In contrast, the end product of the Green Cone's decomposition process is a liquid which seeps into the surrounding soil. This also functions as a soil conditioner.

4. Summary of how the research was undertaken.

Volunteer recruitment

The research contract began on 15th October 2001. Subsequently the 35 volunteer households previously identified were contacted again to ascertain if they were still willing to participate in the Waste Away Scheme Phase 2 research project.

A letter (Appendix 4) was written by Roslyn Associates on behalf of ECOLINC as an introduction to the research project, and to ask householders to confirm their wish to volunteer. This letter was approved by the ECOLINC Co-ordinator and subsequently sent to the 35 potential volunteer households.

Enclosed with the letter were the following items:

1. An agreement letter (Appendix 5a) was formulated containing essential information for volunteers to read and agree (with a copy for them to keep Appendix 5b)
2. A lifestyle questionnaire was developed to gather information regarding individual household demographics and detailed eating habits, and to collect data on where kitchen organic waste currently went e.g. wheelie bin, Green Cone, compost, pets etc. (Figure 2). (N.B. Figure 2 was filled in by both household participants who already had a Green Cone and also the 20 households who were given a new Green Cone so they could participate in the research project.)
3. A draft weight record sheet with some example weight completions (Figure 3)
4. A pre-paid return envelope was supplied

The response from the 35 potential volunteers was very low. A decision had to be made at this point whether or not to abandon the project. Most of the discussions/agreements regarding the decision making process took place with Mary Duncan the ECOLINC Co-ordinator.

The co-ordinator began to source her contacts, including ECOLINC members, for likely volunteers who would receive a free Green Cone if they agreed to participate in the research project. The Co-ordinator was very successful.

Roslyn Associates re-visited the database of questionnaire responses from Waste Away Phase 1 and identified by analysis those respondents most likely to be interested in volunteering for Phase 2. This included some respondents, who although on the database, had not got a Green Cone because the previous occupants had taken it with them. Roslyn Associates then telephoned approximately 80 households and 19 households said they would participate over the phone and were sent a letter, agreement forms and lifestyle questionnaire (Appendix 4, 5a/b and Figures 2, 3), (15 of these subsequently became volunteers). Phone calls were also made to those original volunteers who had not responded to Appendix 4, 5a/b and Figures 2, 3.

As a result of extra work by the co-ordinator of ECOLINC and Roslyn Associates a final total of 63 volunteers were recruited, a considerable success. All volunteer households (shown in Table 1) were located in Moray apart from two controls, one of which was Roslyn Associates and one a representative of the British Association for the Advancement of Science – whose household is located in Aberdeen. Two controls were set up in case any problems/issues were raised throughout the research project. Since no-one raised any problems during the weight record period the control data was utilised and analysed into the main body of data.

Figure 2 Lifestyle questionnaire.



LIFESTYLE/EATING HABITS HOUSEHOLD QUESTIONNAIRE

Dear Householder,

Thank you in advance for agreeing to help us in weighing your kitchen waste, prior to putting it in the Green Cone. In order to be able to interpret your results more fully and to make some comment about population demographics it would be helpful if you could spend a couple of minutes providing the information requested below.

Age Groups in years	FEMALE <i>Number?</i>	MALE <i>Number?</i>	Eats Meat <i>Number?</i>	Eat Fish <i>Number?</i>	Vegetarian <i>Number?</i>
0-5					
6-10					
11-15					
16-19					
20-29					
30-39					
40-49					
50-59					
60-69					
70-79					
80-89					
90-99					

Please tick any box to show where you put the following types of kitchen food waste:

WASTE	Green Cone	Wheelie Bin	Composter/ Compost heap	Straight onto the garden	Pets food e.g. Dog or Cat	Other animals/ birds
Meat						
Fish						
Vegetable/peelings						
Plate scraps						
Fruit						
Bread/cakes etc.						
Milk						
Other dairy – cheese, yoghurt etc.						
Teabags/tea/coffee grounds						

Since using the Green Cone, can you estimate how much waste you put into the Green Cone during a 'normal' week _____ pounds/kilograms (*please circle the measurement you chose*). We will then compare your estimate with the actual amount recorded per week during the 12-week trial.

PLEASE RETURN THIS FORM WITH THE SIGNED LETTER OF AGREEMENT IN THE PRE-PAID STAMPED ADDRESSED ENVELOPE PROVIDED.

Figure 3. A weight record sheet with some completed weight examples/ information to show the householder how to complete the form



The North East Environmental Network.
Waste Away Scheme Phase 2.

Weeks 1 to 4: DECEMBER 2001

Weight Record Sheet 1.

REF NO:

My weights are recorded in Kilograms and grams or pounds and ounces (please circle the measurement you are using)

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
3 rd TRIAL BEGINS	4 th	5 th	6 th	7 th	8 th	9 th 2.2kg
10 th	11 th	12 th	13 th Away	14 th Away	15 th Away	16 th Away 1.3kg
17 th	18 th	19 th	20 th 1.7kg	21 st	22 nd	23 rd 1.3kg
24 th 0.7kg	25 th Away	26 th	27 th	28 th	29 th	30 th 2.5kg

NOTE: Please weigh and empty the kitchen caddy and contents at least every Sunday (or Monday before you put in more waste) and insert the figure into the Sunday column. If you are away at all i.e. on that day the household would not be producing any foodwaste to go in the kitchen caddy then please note away on each calendar day or week.

If at any point you have questions or encounter any problems then please phone Dr Melanie Jones on 01467 642114 Monday to Thursday 9am-8.30pm and she will endeavour to answer your query.

Table 1. Location of volunteer households

Location of Volunteer Households	Number of households at each location
Aberdeen	1
Buckie	5
Cullen	1
Elgin	16
Findhorn	1
Fochabers	8
Forres	15
Hopeman	1
Keith	5
Kemnay	1
Kinloss	1
Lhanbryde	1
Lossiemouth	2
Mosstodloch	3
Portlethen	1

The increased number of volunteers above the requirement (i.e. 50) also allowed for a high drop-out rate over the course of the 12 week period. These extra volunteers were not costed for in the original proposal in terms of consumables or Green Cones. At this point Green Cone Ltd were approached and asked if they would contribute 10 extra kitchen caddies/shakers/accelerator powder and 5 more complete Green Cone systems (this was in addition to the 15 free Green Cone systems and the 52 free kitchen caddies already agreed). They approved the request. Without this input from Green Cone Ltd at this point, the research project could not have been completed.

Equipment

Green Cone Ltd had originally sourced a weigh balance scale, however the trial scale was found to be too small, difficult to read, difficult to hold steady with the kitchen caddy on it, and only came marked in kilograms and grams. Both metric and imperial were required to reflect the age range of the volunteers.

A search was carried out for more scales, however there were no other spring balance scales on the market. At this point it was decided to source an ordinary kitchen scale. Although more expensive than the weigh balance scale it was decided that it was crucial to have equipment that the volunteers would be comfortable with, and competent at using to give accurate results.

Chulmleigh Hardware (identified on the internet), were contacted by phone and a deal was brokered for a good quality household scale for all 63 participant households (@£510 total including postage to individual households).

An offer was made by a company in Aberdeen (DNV) to recycle white good quality presentation files if a donation was made to *Children in Need*. Sixty three were purchased for £10 and the volunteers were made aware of the fact they were receiving recycled files, thus reiterating the recycling message.

Each household was posted a recycled white file in November 2001 which contained the following:

1. An instruction leaflet (Appendix 6)
2. Three weight record sheets one for each 4 week period. Each household was given a unique reference number so that they could be traced back to the address database.
3. Inserted between the record sheets were return paid addressed envelopes so that the weight record sheets could be posted back to Roslyn Associates every month.

Workshop

A workshop was run on 1st December 2001 in the Town Hall in Elgin for 18 volunteers who had indicated they would like assistance on the agreement form (Appendix 5a/b). A demonstration was given on how to use the weigh scales, detail was provided on what organic kitchen food waste could be put into the Green Cone. Volunteers were shown how to fill in the weight record sheets. Many of the volunteers were enthusiastic and asked questions. Any questions/queries raised by the volunteers were answered during the process.

Time scales of survey

The householders all began to weigh their kitchen organic food waste during the week beginning 3rd December 2001 and finished weighing their waste on 24th February 2002.

Analysis

The results were collected in 4 weekly periods. The first batch of data was processed in January and the results entered onto an Excel spreadsheet. Participants who had not responded were identified from the data base and were contacted. The second batch of data was counted and the response rate was good enough to wait until the third batch arrived prior to entering all the results onto the spreadsheet. At this point the lifestyle data was also entered onto the spreadsheet for analysis.

The research quota required for Waste Away Phase 2, was a minimum of 50 volunteer households. This was calculated on the requirement to obtain a large enough sample size (within 95% confidence limits) of the total 863 households with Green Cones on Moray Council's database. As there were 63 volunteers, the research project started with a representative sample. As can be seen from the response rate data in Table 2, with 177 responses out of a possible 189 responses the overall response rate was 93%. N.B. All of the returned weigh record sheets were used in the analysis, none were spoilt.

Table 2. Response rates for the 12 week waste weigh period.

Time period	Responses	Percentage
Weeks 1-4	60	95%
Weeks 5-8	59	94%
Weeks 9-12	58	92%

A note on the results

1. A household weighing their organic kitchen food waste in the Waste Away Scheme Phase 2 research project will from now on be referred to as a participant household. The baseline data from which the analysis was carried out is not given in this report. Roslyn Associates can be contacted for further detail if necessary.
2. The format for Section 5 of the report is to give the result and discuss them immediately to minimise repetition.
3. The results are summarised into charts (both graphs and pie charts) with interpretation as necessary.
4. A summary of results can be found on page 1
5. Suggested action points arising from the results given in the text are noted by the symbol ↗ AP. A full list of action points is given on page 3.

5. Results and interpretation: lifestyle questionnaire

The lifestyle questionnaire response rate was 94%, with 59 total responses out of the 63 household participants. The responses allow conclusions to be made about household demographics and eating habits.

Participant household demographics

Chart 1 shows the age characteristics of the 151 people within the 63 participant households. The average number per household is 2.41. There are 76 males and 75 females with a spread across all age ranges and most gender groups. The data shows the majority of participants are in the 30-70 age range. No clustering is found around one age or gender group.

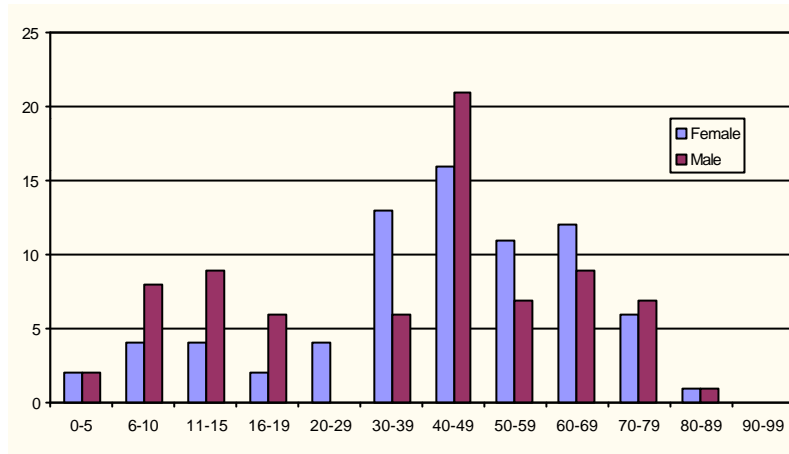


Chart 1. Age range in years of the members of participant households

Eating habits

Of the total 151 members of the participant households, 90% eat meat, 95% eat fish and 8% are vegetarian. This data gives an indication of the type of waste that may go into the Green Cone.

Organic kitchen food waste disposal.

Prior to commencement of the research trial, information was gathered by lifestyle questionnaire (Figure 2) on where the 63 participant households put their organic kitchen food waste. Of the 63 participant households 30% did not have a Green Cone when they filled in the lifestyle questionnaire. The combined results for both those households with a Green Cone and those 20 households who were given a new Green Cone and are shown in Charts 2 to 10.

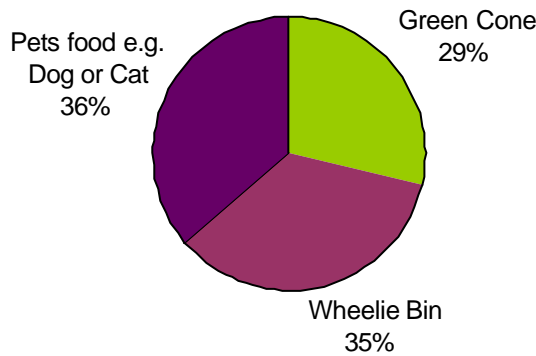


Chart 2. Meat waste diversion

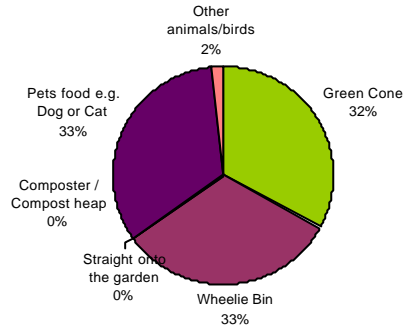


Chart 3. Fish waste diversion

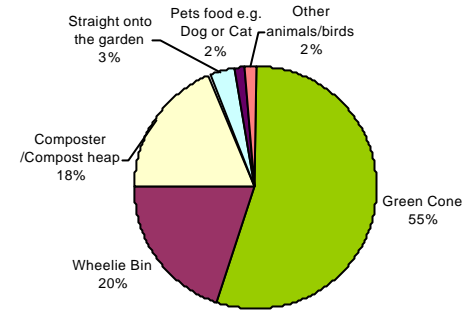


Chart 4. Vegetable Peelings diversion

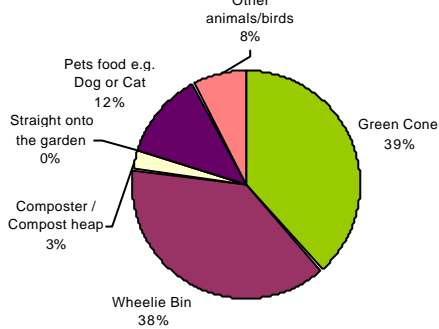


Chart 5. Plate scraps diversion

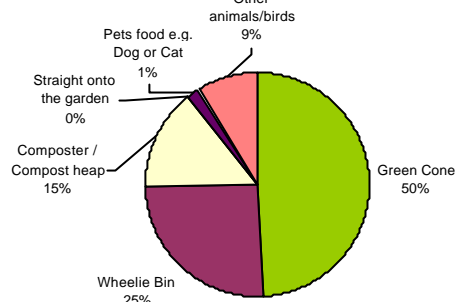


Chart 6. Fruit waste diversion

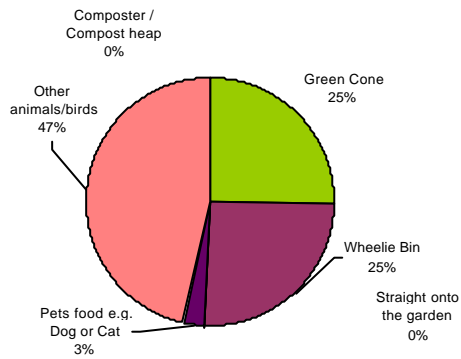


Chart 7. Bread/cakes etc. diversion

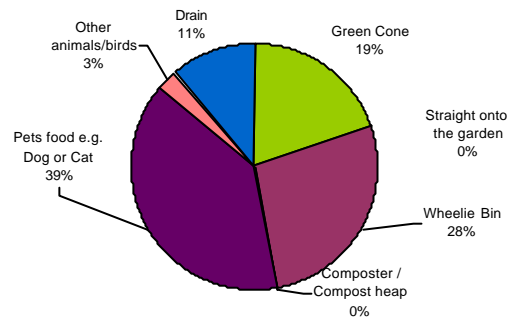


Chart 8. Milk waste diversion

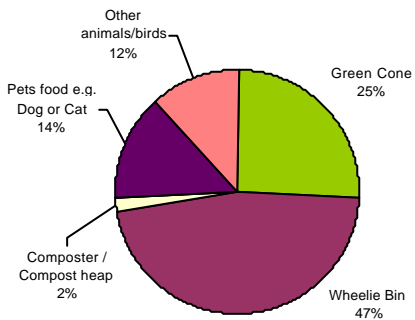


Chart 9. Other dairy products (cheese, yoghurt etc.) diversion

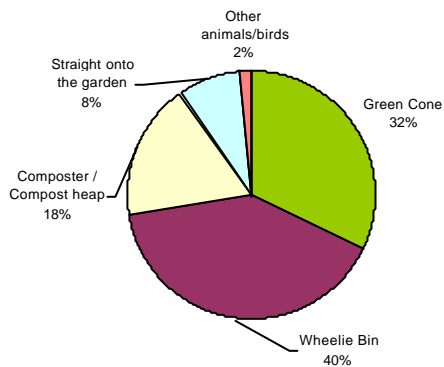


Chart 10. Tea (bags)/coffee grounds diversion

Chart 2 shows where household participants put their meat waste. Pets consume a high proportion of meat waste. Only 29% of the meat waste goes to the Green Cone which is low considering that the Green Cone is designed to deal with meat waste and bones. The wheelie bin received 35% of the meat waste and this is waste that could be diverted to the Green Cone. No meat waste was put straight on the garden, the compost heap/composter or given to other animals/birds.

Chart 3 shows where participants put their fish waste. Pets and the Green Cone consume 65% of fish waste. The wheelie bin received 33% of the fish waste and this is waste that could be diverted to the Green Cone. No fish waste was put straight on the garden or the compost heap/composter.

Chart 4 shows where participants put their vegetable peelings. Pets consume only 2% of this waste with the majority (55%) of vegetable peelings going to the Green Cone. The 18% of vegetable peelings being put on the compost heap or to a composter could also be consumed by the Green Cone. The wheelie bin received 20% of vegetable peelings and this is waste that could also be diverted to the Green Cone.

Chart 5 shows where participants put their plate scraps. Pets consume 12% of this waste with 39% of plate scraps going to the Green Cone. Only 3% of plate scraps go to the compost heap or to a composter, though these could be consumed by the Green Cone. The wheelie bin received 38% of the plate scraps and this is waste that could be diverted to the Green Cone. No plate scraps are put straight on the garden.

Chart 6 shows where participants put their fruit waste. Pets consume 1% of this waste with 50% going to the Green Cone, 15% of fruit waste goes to the compost heap or to a composter, though these could be easily be consumed by the Green Cone. The wheelie bin received 25% of the fruit waste and this could be diverted to the Green Cone. No fruit waste is put straight on the garden.

Chart 7 shows where household participants put their bread/cake waste. Other animals/birds consume 47% of this waste with Pets consuming 3%. 25% of bread/cake waste goes to the Green Cone. The Wheelie also Bin received 25% of the bread/cake waste and this could be diverted to the Green Cone. No bread/cake waste is put straight on the garden or on the compost heap/composter.

Chart 8 shows where household participants put their milk waste. Pets consume 39% of this waste while other animals/birds consume 3%; 19% of milk waste goes to the Green Cone whilst the 11% that goes down the drain could easily be diverted to the Green Cone. The wheelie bin received a high figure of 28% of the milk waste and this could easily be diverted to the Green Cone. No milk waste is put straight on the garden or on the compost heap/composter.

Chart 9 shows where participants put their other dairy products (cheese, yoghurt etc.). Pets consume 14% of this waste. Other animals/birds consume 12% and 25% of milk waste goes to the Green Cone, whilst 2% goes to compost (this could easily be diverted to the Green Cone). The wheelie bin received a high figure of 47% of the other dairy products and this could easily be diverted to the Green Cone. No dairy products are put straight on the garden or down the drain.

Chart 10 shows where participants put their tea bags/coffee grounds. Other animals/birds consume 2% of this waste, whilst 8% goes straight onto the garden. 32% of tea bags/coffee grounds goes to the Green Cone. The 18% that goes to compost could be diverted to the Green Cone. The wheelie bin received a high figure of 40% of the tea bags/coffee grounds and this could be diverted to the Green Cone. No tea bags/coffee grounds are put straight on the garden or down the drain.

Fletcher *et al* [13] make the point that compositional analyses of dustbin waste does not necessarily take account of compostable wastes which may already be being recovered or reused or disposed in some other way. The lifestyle questionnaire results support their assumption since a large proportion of the householders indicated they were diverting their organic kitchen food waste not to the Green Cone but to Pets and other wildlife etc.

Further analysis of the data was carried out to check where those with an existing Green Cone were diverting all of the waste groups on Figure 2 is shown in table 3.

Table 3. Summary of where the existing participant householders with a Green Cone placed their waste prior to joining the research project.

WASTE	Green Cone	Wheelie Bin	Composter/ Compost heap	Straight onto the garden	Pets food e.g. Dog or Cat	Other animals / birds	Down the drain
Meat	40%	31%			29%		
Fish	45%	30%			23%	2%	
Vegetable/ peelings	79%	4%	13%	2%		2%	
Plate scraps	52%	28%	2%		7%	11%	
Fruit	66%	14%	12%			8%	
Bread/cakes etc.	36%	16%				48%	
Milk	31%	23%			32%	5%	9%
Other dairy – cheese, yoghurt etc.	38%	35%			9%	18%	
Teabags/tea/ coffee grounds	44%	33%	14%	7%		2%	

Table 4. Summary of where the 20 new participant householders without a Green Cone placed their waste prior to joining the research project.

WASTE	Green Cone	Wheelie Bin	Composter/ Compost heap	Straight onto the garden	Pets food e.g. Dog or Cat	Other animals / birds	Down the drain
Meat	5%	45%			50%		
Fish	5%	43%			52%		
Vegetable/ peelings	5%	56%	29%	5%	5%		
Plate scraps	5%	65%	5%		25%		
Fruit	5%	58%	21%		5%	11%	
Bread/cakes etc.	4%	44%			9%	43%	
Milk		36%			50%		11%
Other dairy – cheese, yoghurt etc.		72%	6%		22%		
Teabags/tea/ coffee grounds	5%	60%	25%	10%			

N.B. The percentage indicated for the Green Cone is incorrect since none of the participants had a Green Cone at this point.

Analysis of organic kitchen food waste disposal for existing Green Cone Users.

The combined data for existing Green Cone users and new Green Cone users as shown in Charts 2-10 needs to be looked at with the data on Table 3 and 4 since, for example, the meat waste diversion on chart 2 shows 35% going to the wheelie bin. Unfortunately this 35% is not made up of just new Green Cone users but includes a high proportion of existing Green Cone users as well. Table 3 shows clearly that there is still a lot of potential for the existing Green Cone users, some of whom have had their Green Cone for between 6-10 years [1] to divert their waste from the wheelie bin.

The 'educational message' regarding what can be put to the Green Cone has clearly worked in some cases, however as the data shows in, for example, meat and fish waste, 30% of participant households are still not diverting this waste from the wheelie bin to the Green Cone. Likewise with plate scraps, fruit, bread/cakes, milk, other dairy products and tea/coffee grounds there is still a great potential for diversion to the Green Cone.

These figures indicate that there is a strong reason for an educational programme to be formulated for all those people who currently have a Green Cone, this could take the form of a video or educational pack. This educational information could then be distributed with all new Green Cones and be incorporated into the cost of them so as to ensure that the full potential of diversion of organic kitchen food waste from the wheelie bin to the Green Cone is reached. ✨ **AP**

The database of results for Waste Away Phase 1 was consulted to provide additional information on the existing Green Cone users to supplement the data in Table 3. Twenty nine volunteers who participated in Phase 1 and came forward to participate in Phase 2. Of the 29 participant households, 26 households already used the Green Cone all year round. Also 26 out of the 29 participant households had a compost heap or compost unit which is the ideal complement to the Green Cone since green waste (i.e. garden waste) should not be placed in the Green Cone. Of the 26 participant households, 17 stated that they placed Green Waste (i.e. lawn cuttings, leaves, weeds etc.) in the Green Cone in their answers to the questionnaire (see Appendix 7) from Waste Away Phase 1 [1]. Hopefully receipt of the letter (Appendix 3) asking householders not to put Green Waste in the Green Cone will help to break this habit.

Analysis of organic kitchen food waste disposal for 20 new household participants.

Household participants were not asked to change their lifestyle habits for the sake of the Waste Away Phase 2 research project but were expected to divert any waste that would normally have gone to the wheelie bin or the compost heap/unit to the Green Cone. The data in Table 4 reflects where the 20 new participants households placed their waste prior to being given a Green Cone in order to take part in the trial. As expected the wheelie bin takes the majority of the waste categories shown in Table 4. There are indications however that some of these participants had compost heap/units which is excellent as the Green Cone will complement this existing unit not compete with it. It is interesting to note how many participant households recycle their organic kitchen food waste to pets and other animals and birds. The Waste Away Phase 2 research project was designed to calculate the amount of organic kitchen food waste going to the Green Cone so the amounts going to pets and other animals and birds are effectively unknown. Household participants were not asked to change their lifestyle habits for the sake of the Waste Away Phase 2 research project but were expected to divert any food waste that would normally have gone to the wheelie bin or the compost heap/unit to the Green Cone.

Perception of waste created

In addition to gathering information about household demographics, household eating habits and where the organic kitchen food waste was actually put, the questionnaire (Figure 2) asked household to estimate how much waste they put to the Green Cone per week. Analysis of this data for the existing Green Cone users compared with the actual amounts recorded on the weight record sheets showed that 66% of households underestimated how much they actually put in the Green Cone. This is backed up by the fact that when trying to recruit volunteers, many of them stated that they did not produce enough waste to warrant inclusion in the research project though when persuaded to come into the project they clearly produced more than they thought they did. The perception of minimum weight needed to make the activity worthwhile features highly in composting behaviour just as it does in recycling [13].

6. Results and interpretation: Waste diversion statistics

Statistics provided by The Moray Council

The data in Table 5 and 6 was supplied by The Moray Council and is used to supplement calculations made from the results analysed out from the weight record sheets.

Table 5. General statistics regarding population, household number and waste arisings.

39,700	number of households in Moray
87,000	population of Moray
£44.00	cost per tonne for collection of MSW based on The Moray Council budget figure for 2001/2
£1,546,968	global figure for cost of disposal of waste in Moray
108,768	tonnes total waste disposed of
34,832	tonnes collected MSW disposed of
28,000	tonnes assumed domestic proportion of 34,832 collected MSW
40%	of households to be composting their organic waste – waste strategy document
6, 9, & 15	Tonnes represents the variation in tonnage capacity of collection vehicles used by The Moray Council

S. Williamson, Personal Communication [18] April 2002. Unpublished data.

Table 6. Data collected from a 1 week household waste analysis carried out by The Moray Council in October 1999.[1]

Individual Waste type	Weight (kg) per household	Weight (kg) per person	Volume %
Paper and card	3.092	1.279	27.07
Compostables	2.600	1.076	12.03
Glass	1.192	0.493	3.01
Metals	0.458	0.190	4.51
Plastics	0.533	0.221	22.56
Textiles	0.217	0.090	6.77
Miscellaneous	2.833	1.172	24.06
Total	10.925	4.521	100

S. Williamson, Personal Communication [19] August 2000 in [1].

The data in Table 6 gives an indication of the components of the waste stream in Moray. However this data is valid only for the week in which it was carried out in October 1999. The compostable weight for the one week waste analysis was 2.6kg. However since the 2.6kg figure includes **green waste** from the garden, combined with food waste it is likely that the 2.6kg is an underestimate. This figure may rise if the waste audit was carried out over a longer time scale because of seasonal variations. As a comparison, Cheshire County Council have provided Roslyn Associates with data from a survey undertaken in February, June and October 2000 [20]. Waste was collected from 250 households. Of this kitchen waste accounted for 11% (2.1kg/hh/week) and garden waste accounted for 14% of the total 2.5kg/hh/week i.e. 4.6kg total as compared to 2.6kg total in Moray.

Waste Away Phase 2 results on diverted waste from landfill

Of the 63 participant households in the Waste Away Phase 2 research project, over 90% subsequently posted their weight record sheet back for analysis. Analysis of this data allowed the following figures to be calculated.

1. Over the 12 week period of the research the participants removed approximately 2 metric tonnes (Te) (2060kg actual) of organic kitchen food waste from the waste stream
2. The average participant household collected 2.9 kg per week organic kitchen food waste i.e. on average 2.9kg per week was diverted from landfill during this period
3. The maximum figure diverted from landfill in any week was 3.3kg per household (hh)
4. The minimum figure diverted from landfill in any week was 2.4kg per household (hh)
5. The 12 week mean average for waste diverted to the Green Cone per person/per day is 0.18kg
6. The 12 week maximum for waste diverted to the Green Cone per person/per day is 0.21kg
7. The 12 week minimum for waste diverted to the Green Cone per person/per day is 0.15kg

Calculations made using Waste Away Phase 2 data and The Moray Council statistics

- Taking the mean average of 2.9kg/hh/week organic kitchen food waste put into the Green Cone and extrapolating it over a year; the average household could divert **151kg from landfill**. Evidence for being able to extrapolate the data over a year, even though the Waste Away Phase 2 project is a 12 week study, comes from:
 - a) Jasim's Ph.D. work [7] found that "food waste" weight data did not vary significantly over a 2 year research period.
 - b) Appendix 8 is a summary of the base data from the Waste Away Phase 2 project and indicates that the weight data for Waste Away Phase 2 is relatively consistent over the 12 week period
- If all 39,700 households in Moray removed an average of 2.9kg organic kitchen food waste per week then **6,006 tonnes** (Te) would be removed from the waste stream per year. 6,006 tonnes of waste removed from the waste stream is **21%** of the 28,000 tonnes per year of **domestic waste produced in Moray** (Table 5). Since national figures for the amount of putrescibles in household waste vary from 20% in the DOE NHWAP analysis in 1992-93 [2] up to 26% in the Scottish Office Bulletin for 1996 [4], then the data for Moray is consistent with these studies.
- Taking the 2.9kg/household weekly mean average per week and extrapolating it over **10 years** (i.e. when The Moray Council first issued Green Cones) then the average household could have diverted **1.5 tonnes from landfill during this 10 year period**.
- The Moray Council issued 1100 Green Cones between the years 1992 to 1995. Assuming all the Green Cones issued are still in use, this equates to **165.8 tonnes/year already being diverted** from landfill. This is probably an overestimate since it is not known exactly how many Green Cones are still in use, but shows the potential for waste diversion (using the 2.9kg average per week per household).

40% of Households to be home composting? [21]

The Moray Council waste strategy target is for 40% of households to be engaged in home composting (including diverting organic kitchen food waste to the Green Cone). If this target is reached then:

- **2402 tonnes** of organic kitchen food waste could be removed **per year**.
- **9% (2402 tonnes)** will be removed from the total domestic waste stream (28,000 tonnes per year-Table 5).
- at a disposal cost of £44/tonne, **£106,000 per year could be saved**. This money could be diverted to pay for capital costs of the required Green Cones and/or home composting units. ✓ **AP**.
N.B. 3,523 Green Cones could be purchased with the £106,000.

If The Moray Council chose to utilise Green Cones to fulfil the 40% target for households to be engaged in home composting then, taking into account the 1100 Green Cones already issued (2.8% of total households in Moray), the council would need to purchase an additional 14,780 Green Cones at an estimated cost of £443,000.

- If 40% of households in Moray were to compost their organic kitchen food waste and 2402 tonnes per year was removed then **267 vehicle trips per year could be removed from the collection round** (utilising a 9 tonne full capacity collection vehicle). There would be resultant 'savings' on fuel, road wear, noise, pollution and traffic congestion.

Legislation and enforcement agency drivers: fulfilling the Landfill Directive targets and the 40% home composting target

According to the DETR, [22] waste arisings are increasing by 3% every year, however the draft area plan for N.E. Scotland gives a more localised figure of 1.5% [23].

The EU Landfill Directive (99/31/EC) requires a reduction of biodegradable waste placed in landfill to 75% of the 1995 levels by 2006, 50% by 2009 and 35% by 2016. The UK government will take a derogation so the 75% target data is now 2010 instead of 2006 [24].

To reach 75% of the 1995 levels by 2010, the whole of the North East of Scotland (Aberdeen City, Aberdeenshire and Moray) will need to divert **49,024 tonnes of biodegradable municipal waste (BMW)** from landfill [10].

With the results of the Waste Away Phase 2 research project it can be calculated that 166 tonnes are potentially being diverted from the 1100 Green Cones already in Moray. Taking this data, Moray Council could argue that they are currently reducing biodegradable waste placed in landfill by **1% of the 1995 levels** which was 28,870 tonnes BMW.

Table 7 shows some of the calculations made to see if Green Cones alone, can fulfil the Landfill Directive Target by 2010 and the 40% home composting target.

Since 83% is the maximum that Green Cones can take out of 7217.5 tonne biodegradable landfill reduction target then it would not be possible to completely fulfil the target utilising the Green Cone.

The 83% figure also assumes that all 39,700 households in Moray would use them. Clearly this is an unrealistic expectation.

Table 7. Calculations (based on Waste Away Phase 2 results) made to assess ability of Green Cones to fulfil landfill directive and 40% home composting strategy.

1995 base level of biodegradable municipal waste (BMW) in Moray	28,870*	Tonnes
Amount of BMW allowed to go to landfill in 2006(2010) under the directive	21,652.5	Tonnes
Target amount BMW to be removed from waste stream to meet directive (75% of the 1995 BMW arisings)	7,217.5	Tonnes
Potential organic kitchen food waste removed from <u>all</u> hh/year by Green Cones (based on 2.9kg/hh/week)	6,006	Tonnes
Maximum that Green Cones could take out of the 7,217.5 BMW directive target (utilising 6,006te/year/ <u>all</u> households)	83	%
Amount organic kitchen food waste removed if 40% home composting in Moray target is reached	2402	Tonnes
Percentage of 7217te removed, if 40% (2402te) home composting target achieved using Green Cones.	33	%
Deficit of BMW still to be removed from waste stream if 40% target of home composting achieved.	4,815	Tonnes

*Source Steve Williamson Personal Communication May 2002 [21].

The 4815 tonnes of biodegradable waste still to be taken out of stream when 40% of householders in Moray have been persuaded to take up home composting is a significant amount (Table 7). Biodegradable waste according to the DETR [22] is classified as paper and card waste, and putrescibles (both kitchen and garden waste). Since biodegradable waste also includes paper and card, and The Moray Council has a centralised composting scheme it is assumed that this figure of 4815 tonnes can be met in their strategy by either or both the centralised composting scheme or paper recycling. It is not within the remit of the Waste Away Phase 2 research to advise on Waste Strategy implementation since this is being carried out by The Babbie Group [25].

Some countries in Europe such as Germany and Belgium use mechanical biological treatment (MBT) to draw off recyclables, compost and incinerate the residue. By these means they plan to meet the landfill targets. One unique example in Scotland is the composting plant located at Inverboyndie in Aberdeenshire. The plant may well form part of the overall waste management strategy for the area. At full capacity it can take 20,000 tonnes of mixed domestic waste (not all BMW). The composted material is put to landfill as daily cover rather than being incinerated.

Should The Moray Council wish at any point to incorporate a Materials Recovery Facility (MRF) in their waste strategy then removal of the organic kitchen food waste at source would reduce the hazard to human health at the MRF and possibly increase the value of the recyclables.

N.B. Other 2002 literature has been traced which maybe of use for The Moray Council to compare strategies with other countries e.g. 1) Europe European Topic Centre [26], 2) A review of selected waste streams carried out by the European Environment Agency [27].

7. Comparison of Waste Away Phase 2 results with similar studies

Comparison of the recorded 2.9kg/hh/week mean kitchen food waste with published data.

The Henry Doubleday Research Association (HDRA) classifies kitchen waste into compostable and non compostable³ [op cit 13]. Of the non-compostables, including gravy, fat, meat and bones, fish, cheese rinds, nuts, seeds and pet droppings, all can be consumed by the Green Cone. Many research studies only measure the compostable fraction of kitchen waste and some studies mix both the green waste and kitchen waste both compostable and non-compostable together for their measurements. There were considerable difficulties in locating similar studies to the Waste Away Phase 2 research with which the results could be directly compared. However all the studies that were located are given in this section.

- During 1992 and 1993 dustbin analyses carried out in Leeds, Warrington, Charnwood, Gateshead and St Albans for putrescibles (kitchen and garden waste) gave a figure of 21% of the dustbin contents. Overall the mean putrescible (kitchen and garden waste) weight arising (combining inter-community, seasonal and housing types) was 2.613+/- 0.8195 kg/household(hh)/week [28]. The bulk of the putrescibles in this study were found to be kitchen waste not garden waste [29 Benfield, 1997].
- During April and September of 1994 and 1995, Nesaratnam *et al* [30] and Jones [et al 31a/b] collected and analysed data from 426 Open University students all over the UK. The mean quantity of putrescibles (kitchen & garden) in the dustbin was found to be 3.4kg/hh/week.
- A study in Luton (Coggins *et al* 1997, in *op cit* [13]) found the weekly compostable kitchen wastes (i.e. peelings, fruit and vegetable, tea leaves/bags, cut flowers/plants) to be 3kg/hh/ week in inner Luton and 2.3kg/hh/week in outer Luton. These figures however do not include non-compostable waste which include gravy, fat, meat and bones, fish, cheese rinds, nuts, seeds and pet droppings.
- Over a 3 month period in May – July 1999 a study by Fletcher *et al* [13] measuring the amount of kitchen, garden and other waste going to compost gave an average weight of 1.6kg/hh/week.
- Waste composition data from a study undertaken in Hampshire by MEL [32] contained data for both kitchen compostable and non-compostable measure from kerbside collection schemes. Appendix 9 shows the data extracted and recalculated over the two month period between March and April 1999. The mean average collected was 2.54kg/hh/week.

Apart from the study by Fletcher [13] and the MEL study [32] none of them were specifically designed to measure organic kitchen food waste (both compostable and non- compostable) so care has to be taken when making direct comparisons of the Waste Away Phase 2 results. However the two that are most comparable to the 2.9kg/hh/week Waste Away result is the 2.6kg/household/week result (DoE [28], Benfield [29] since the study noted the bulk of the waste was kitchen waste not garden waste) and the 2.5kg/hh/week MEL study [32].

A more recent but unpublished study by Greenfinch Ltd, [33] has data from a survey of 80 households in Burford who source separated their organic kitchen food waste between April 2001 and January 2002. The average kitchen bag weight over this period was 3.4kg/hh/week. This figure includes both compostable and non compostables.

The following information was summarised from an unpublished report by Oxford Brookes University, Centre for Environmental Studies, on the Green Cone Trial carried out by West Oxfordshire District Council (WODC) completed in February 2002 [34]. It is the only research currently available that can be directly compared with the Waste Away Phase 2 results since both studies were measuring organic kitchen food waste diverted to the Green Cone.

³ Whenever this report mentions compostable and non compostable it has the same meaning as defined by HDRA

The report was prepared by the Centre for Environmental Studies for Green Cone to validate a trial of the Green Cone food waste digester carried out by WODC.

The aims of the study were to investigate the amount of waste that could be diverted from landfill through their use, and what, if any, barriers there are that discourage their use in domestic residences.

A total of 50 Green Cones were distributed to volunteers for the trial, and 32 participants returned data. The data was collected over a six-month period, from April to September 2001, the warmest part of the year and therefore theoretically the optimum time for the Green Cone to operate.

Data on weight and volume and when the 'kitchen caddy' was emptied into the Green Cone was entered by trial participants onto a datasheet. A note was also made as to whether accelerator powder was used.

Trial participants were recruited through an advertisement in the local press, an e-mail to all staff employed by the Council and to all councillors. The sample therefore, is not necessarily fully representative of the general population, as it stands to reason that those who volunteer are likely to have some interest in environmentally conscious waste management.

The main results are as follows:

- Over the six-month period of the trial, almost 10 kg of food waste per household per month was being put into the Green Cone. There is an average of 3 people per household in this trial.
- The first month of the trial recorded an average 10.75 kg per household going into the Green Cone. This dropped to 8.9 kg in month 5, but improved to 10.44 kg in month 6.
- Four of the cones in the trial, situated in sunny positions, each handled over 100kg of food waste in the six month period
- One Green Cone, situated in partial sun, became full after taking 63 kg of waste in 4 months

Waste Composition

- 38% included meat and bones in the contents of their waste deposited in the Green Cone.
- Cooked food was put in the cone by 71% of respondents
- 75% were using it for vegetable peelings and similar organic matter

One of the conclusions of the study was that the monthly average per household of about 10kg of food waste placed in the Green Cone, equating to about 12% of the domestic waste stream, a significant reduction. Assuming widespread take-up of the Green Cone throughout West Oxfordshire, the potential reduction in the waste stream could be in the region of 3,500 tonnes.

The data from the WODC study showed a smaller weekly weight average of 2.5kg/hh/week as compared to the 2.9kg/hh/week measured in Moray. This then reflects in the 120kg of waste/hh/year potentially diverted in Oxfordshire compared to the 156kg/hh/year potential diversion in the Waste Away Phase 2 research project.

The waste composition data given by WODC is interesting in that whereas 38% were diverting meat waste to the Green Cone whereas chart 2 (Waste Away Phase 2 results) shows only 29% of householders reported diverting their meat waste to the Green Cone. The WODC survey did not ask about where the waste was being diverted e.g. pets or wheelie bin and therefore it is difficult to comment further on this.

Unpublished Ongoing Research

It is worth noting that there are a number of reports and studies which have been located that are either ongoing or about to be published and when they are available there may be interesting comparisons with the results of Waste Away Phase 2. ↗ AP They are listed as follows:

- Sharon Jasim, Imperial College London, is completing a Ph.D. on the subject of home composting. Results relevant to this research report were released at a conference on home composting on the 21st May 2002 at Imperial College [7] and can be summarised as follows:

64 households took part in a 2 year trial based in the Borough of Runnymede, Surrey. During the two years, households measured their food waste prior to putting it in a compost unit. Since the time frame of the research overlaps with that of the Waste Away Phase 2 project some comparisons are given below. However there will be slight variations due to the fact that Jasim's data is calculated on a monthly basis and the Waste Away Phase 2 data was measured on a weekly basis. The Runnymede participants were also advised not to measure non-compostables i.e. cooked food, meat or fish so one would expect the figures to be lower than the Waste Away Phase 2 data. As can be seen from Table 8 the data vary between 2 and 3 kg/hh/week for both surveys.

Table 8. Food waste arisings comparison between Jasim's data [7] and Waste Away Phase 2 data.

Time period	Monthly kg/hh [7]	Comparative Weekly Average kg/hh*	Data From Waste Away Phase 2 Weekly Average kg/hh*
Dec 2001	8.13	2.03	2.91
Jan 2001	12.31	3.07	3.03
Feb 2002	13.35	3.34	2.77

*Calculated by Roslyn Associates

- Guildford Borough Council – has 11,000 Green Cones with householders. A questionnaire survey which asks (amongst other things) about the amount put to the Green Cone per week has just gone out to householders. The results should be available in July 2002 (contact Eleanor Fielder 01483 505050 for details).
- Green Cone Ltd. – has a number of ongoing research projects which should address various concerns about the material output from the Green Cone. The research will measure if any methane is produced, assess any concentration of heavy metals, pathogens, temperature range reached in the Green Cone and also how far the soil is fertilised as the liquid from the Green Cone leaches into the surrounding garden soil. Further information can be obtained from Green Cone Ltd on 00 44 (0) 1159114372 or sales@greencone.com
- Babtie Group have reviewed options for waste management (completed May 2002 [25]) to enable The Moray Council to clarify their waste management strategy. Whilst Roslyn Associates have not seen the report Roslyn Associates have been informed by Babtie that the report takes the assumptions made by Moray Council i.e. that 13% of the total waste produced by a household could be diverted by using the Green Cones [Appendix 1]. The Babtie Group were given the results of the Waste Away Phase 2 in order that they could have more accurate data. The responses from The Babtie Group is as follows: “We have compared the figures from your study with these assumptions and have identified that this results in approximately 30-10 kg less per household than the waste diversion resulted from your study. We propose to use the figures from your research in our final implementation plan for the Council.” The data from Waste Away Phase 2 has already been of considerable use in the implementation of the waste management strategy in Moray.
- Aberdeen City Council was unable to give out information on their research prior to the launch of the findings in June 2002. However the contact is the Clean and Green Officer, Ian Hays.
- Buchan Countryside Group have an ongoing study with 50 households composting their waste. The Contact is Angela Maycock on 01771 637 393
projectworker@wastenotwantnot.fsnet.co.uk

8. Discussion/suggestions on extending the current Waste Away scheme.

The results of both Waste Away Phase 1 [1] and Waste Away Phase 2 indicate that the current Waste Away scheme should be extended. The Waste Away Phase 2 data suggests that the Green Cone is a viable option to partially fulfil the EU landfill directive targets and achieve sustainable waste management of organic kitchen food waste in Moray. However significant investment would be required in both time and money to ensure that the landfill target is reached by 2010 by whatever strategy is chosen.

It is important that the Green Cones are effectively utilised and a check on the profile of the potential user could ensure that the Green Cone is going to the 'right' home. Roslyn Associates would recommend that a questionnaire is filled in by all householders (the questionnaire could incorporate the lifestyle questions from this study) prior to issuing them with either a Green Cone and/or a home composting unit in order to more correctly assess their needs. This should help to alleviate public money being misdirected ↗ AP. To aid distribution the following profiles are suggested:

Profile 1 Household: requires only a Green Cone

1. have small or large gardens
2. who produce very small or reasonable quantities of organic kitchen food waste
3. would like to take responsibility for their own organic waste
4. would like to keep their Wheelie bin cleaner
5. are not interested in a product e.g. a compost
6. may be within the catchment area for the centralised composting scheme in Moray. If a householder is prepared to segregate green garden waste and take it to a civic amenity site they maybe more pre-disposed to use a Green Cone

Food waste such as meat, fish, bones, dairy products etc should not be put to compost and assuming these items are not disposed of to pets then a Profile 2 household would require both a Green Cone and a Home Compost Unit.

Profile 2 Household:

1. have large gardens which produce green garden waste
2. does not already compost their green garden waste
3. are outside the catchment area for the centralised composting scheme in Moray.
4. who produce reasonable quantities of organic kitchen food waste
5. would like to take responsibility for their own organic waste
6. would like to keep their wheelie bin cleaner

There may also be a 3rd profile household who do not currently compost green waste but want to and do not want to segregate waste to go in a Green Cone. A Profile 3 household would require a compost unit. This should only be provided if the household is outwith the catchment area for Moray's centralised composting scheme.

Tucker [35] has developed a model framework for predicting home composting behaviours within the context of integrated household waste management which revealed some significant statistics about the amount of biodegradable wastes that may be diverted. It would be interesting to see how the model coped with an input of the Waste Away Phase 2 data with organic kitchen food waste (i.e. compostable and non-compostable) going to a Green Cone. Perhaps this could be followed up by The Moray Council or Green Cone Ltd. ↗ AP.

The extract from Tucker's report [35] points to a mixed strategy targeting both kitchen and garden waste for those householders with a garden. Tucker suggests that composting should be emphasised as a waste disposal option rather than a production process since many householders are not interested in the product. For these householders a Green Cone may be more acceptable.

"If more households are stimulated into home composting, the quantity of biodegradable wastes diverted away from the dustbin will not increase pro-rata with the increase in participation. There will be increasingly diminishing returns. This effect is, of course, linked to garden size. Those with larger gardens are more likely to be earlier composters than those with smaller gardens. Once all latent composters are stimulated, the majority of garden waste will have been diverted, though not the kitchen waste. High levels of kitchen waste may still be left in the average dustbin. A reduction of 30% of kitchen wastes going into the dustbin compared with 1995 levels may be all that will be possible, whereas a 65% reduction in garden wastes might potentially be achieved. Modelling has also shown that high levels of home composting will leave significant total arisings of kitchen putrescibles within some areas, but thinly spread over those areas. As such their diversion through other means becomes more difficult. The modelling further highlighted that having a reasonably convenient green waste bring site is an additional important parameter in achieving the maximum diversion to take up those wastes not chosen to be composted at home. A regime of intensive home composting with a close-by green waste drop-off point was found to be nearly as effective [initially] in achieving diversion as a kerbside green waste collection, though continued results might be more difficult to sustain into the longer term."

Extract from Tucker's summary [35]

A national survey by Onyx/NOP [36] indicates that nearly 35% of households nationally are already participating in home composting. To reach the 40% of households in Moray to be home composting target it would be sensible to find out by questionnaire how many households are currently composting as these can then be discounted from the 40% target ↗ AP. In order to reach the landfill directive targets care must be taken to target those households that are not already engaged in composting since it could be more effective to direct resources at these households. ↗ AP. Once new households are brought into the Waste Away scheme then weight measurements could be estimated from weight decreases logged from collection round data and landfill gate weight data ↗ AP.

If compost bins are also issued then previous work by other councils, such as Cambridgeshire County Council (issued over 40,000 subsidised compost bins), could be looked at and their experience utilised ↗ AP. Cambridgeshire County Council along with HDRA set up a *Master Composter Training Programme*, a *Slim your Bin* awareness programme, roadshows, competitions, radio programmes etc. The aim was to educate people on how to compost properly and achieve high quality environmental education [37]. CAT has some interesting ideas on high and low fibre composting (see Appendix 10) which are worth exploring because they involve 'cool' ambient temperatures which may be suited to the Scottish climate [38].

There are a number of home composting trials underway in Scotland, England and Wales where valuable advice/experience can be obtained. One example is the home composting in Telford and Wrekin report [39] which estimated that 5.9kg/week/household could be diverted through home composting. Others (located by IWM) are a study by Bromley Council (tel. 0208 3134557) and an Environment Agency study involving Castle Morpeth (tel. 01670 514351). There are some reports available of previous research (e.g. [40, 41, 42, 43]). However it is often difficult to obtain information because the data is either unpublished or consultancy reports or in-house reports. There is no one repository of information on this subject. This area is outwith the remit of the Waste Away Phase 2 research. The Moray Council, through one of the national bodies, could perhaps obtain information on home composting research from other local authorities ↗ AP.

The Green Cone is suitable for both large and small gardens, and even those with patios, provided the cone can be dug into the ground. If however home compost units are also required for 40% of households as per the strategy then it may be useful to assess the number of gardens which have vegetative cover. The current estimate is that 90% of households in Moray have gardens [19]. In order to accurately assess the size of gardens, G.I.S. products such as *MasterMap*, or high resolution satellite images to assess vegetative cover (with an infra-red spectrum for the two main seasons of the year) could be used. These would enable the current estimate figure to be proved ↗ AP.

Current/future legislative changes

1. In the recent budget statement notice was given that landfill tax will increase to £15 a tonne in 2004/5 and it is likely that there will also be an incineration tax introduced. The costs of waste disposal are therefore on the increase.
2. DEFRA have put forward the idea of *tradable allowances* [44] which could apply to all 1995 biodegradable waste not entering the waste stream. The allowance could potentially be sold to other local authorities and the income could be used for example to help recycling of biodegradable waste e.g. buying more units.
3. Because of recent public health concerns over BSE and foot and mouth there will be changes made to the current Animal By-Products Order 1999. A risk assessment is currently underway to assess risks from the use of compost derived from household and commercial catering wastes [45]. Until the risk assessment is complete in Summer 2002 all such wastes have been banned from application to farmland [44]. The implications of this interim decision are that catering wastes may be shifted towards anaerobic digestion or will have to be landfilled. Green Cone Ltd are awaiting the outcome of the risk assessment before issuing advice with their Green Cones. They have been told by DEFRA that as the Green Cone is partially underground there should be no problems with meat/food waste being added. On emptying the Green Cone the contents (a spadeful?) should not mixed with soil in the garden but re-buried somewhere in the garden, or disposed of to the Wheelie bin.
4. Despite recent media attention in May 2002, there are no plans by DEFRA that all householders that compost (and this would include Green Cone users) would be required to hold a licence [44].
5. Michael Meacher when answering a parliamentary question (week of 17th-23rd May 2002) said that recycling rates will not include home composting (including Green Cones?) because the waste diverted by home composting cannot be measured accurately [35]. It will be interesting to see what the response is from the Scottish Executive. It would be a shame if an opportunity is lost to help fulfil the landfill directive targets, since a number of other European countries do include home composting in their target data [36]. Also there is research underway at the moment by AEA Technology Environment, the Open University and the Environment Agency due to complete in September 2002. Hopefully the results will assess home composting and develop a methodology to assess participation in schemes and diversion of waste away from landfill [46].

Health Warning

During the course of this research the issue of the indoor storage of kitchen waste on health was raised. Limited work has been published on this issue. However a Dutch study [47], evaluated the effect of indoor storage of compostable waste on the concentrations of microbial agents in house dust from living room and kitchen floors. The aim was to assess the risk of bio-aerosol exposures due to indoor storage of organic waste. The conclusions are as follows:

Separate storage of organic waste indoors leads to a significant increase of microbial agent levels in dust from living room floors, independent of other major determinants like type of floor cover. Indoor storage of mixed waste (no separation of organics) did not increase levels compared to indoor storage of residual waste (non organic) only. Both mold as well as bacterial components were elevated. Similar effects were found for dust from kitchen floors. The implication of these increased bio-aerosol levels in house dust on possible adverse health effects is not yet known, but largely dependent on other variables like type of floor cover, temperature and air-humidity.

Should the Waste Away scheme be extended, medical advice should be taken so that anyone with respiratory problems realises the *potential* implications of keeping food waste in their kitchen. Advice from environmental health could be sought on this issue. It maybe that as the waste is covered in the kitchen caddy the potential problem is alleviated. Perhaps emptying their kitchen caddy on a daily basis is sufficient, alternatively they may be advised to not take part in the scheme?

9. Conclusions

The Green Cone has the potential to divert significant amounts from the waste stream since the average household could divert approximately 151kg organic kitchen food waste per year from landfill based on the results of this research project. This figure is based on a 2.91kg per household per week as a mean average. The results support the positive benefit of the current Waste Away Scheme in terms of the amount of potential waste diversion for relatively rural areas.

The data in this report should aid The Moray Council in their waste strategy since they now have reliable figures on which to base a strategy for the diversion of organic kitchen food waste from landfill.

The Babbie Group have indicated that they will use the data in the final implementation plan of overall waste management in Moray. The results have therefore already been made use of.

The results (when combined with the research results from Waste Away Phase 1 [1]) could also be used to support an expansion of the current Waste Away scheme to those areas outwith the centralised composting catchment area.

By utilising the Green Cone the householder can separate and deal with their source separated food waste in the confines of their home environment, this option fulfils both the proximity principle and environmental sustainability issues.

With the results of this research project The Moray Council could argue that they are already reducing biodegradable waste placed in landfill by 1% of the 1995 levels purely based on the 1100 Green Cones already in Moray diverting a total of 166 tonnes.

The main aim of this research was to see if extending the current Waste Away scheme would help to meet part of the landfill directive targets to reduce biodegradable municipal waste (BMW) going to landfill. The Moray Council needs to divert 7217.5 tonnes of BMW in order to reach the directive target. If all households in Moray had a Green Cone (an unrealistic target) then the amount of BMW diverted would be 83% of the required 7217.5 tonnes. The Moray Council could not therefore meet the directive's requirement solely by diverting organic kitchen food waste from all households. However utilising Green Cones as part of an overall strategy is quite feasible.

The Moray Council's current strategy is that 40% of households will be engaged in home composting (including Green Cones). If this target is reached based solely on the use of Green Cones then 2402 tonnes of organic kitchen food waste could be removed per year which is 9% of the total 28,000 tonnes domestic waste stream and 33% of the 7217.5 tonne directive target.

The lifestyle questionnaire results show that there is enormous potential for the existing Green Cone users (some of whom have had their Green Cone for between 6-10 years [1]) to divert their meat, fish, plate scraps, dairy, fruit and bread etc. waste from the wheelie bin. Since the Green Cone can handle all organic kitchen food waste then some sort of educational programme, such as a video, should be carried out to ensure that those with Green Cones in Moray are using the unit to its full potential.

An unexpected finding from the lifestyle questionnaire results is that up to 35% of the 63 household participants are diverting meat, fish and dairy product waste to pets, birds and other animals. Pets produce organic waste themselves, however, this can also be consumed by the Green Cone. Between 40-50% of household participants diverted their bread/cake and milk waste to pets, birds and other animals.

There appears to be a common misconception on the part of householders as to the amount of organic kitchen food waste they actually produce. Prior to starting the weighing programme 66% of households underestimated how much they would actually put in the Green Cone. This factor may make successful implementation and extension of the current Waste Away scheme more difficult.

If the Waste Away scheme is to be extended and the 40% home composting strategy to be achieved, in partial fulfilment of the landfill directive target, then it is essential that the Green Cones are placed in suitable households. This report has suggested general profiles for a potential *Green Cone household* and also a *Green Cone/Compost unit household*. A questionnaire which addresses both the profile and the lifestyle questionnaire is recommended in order that public money is not wasted and the household are issued with a unit that addresses their needs. The Moray Council may also need to consider decreasing the subsidy on Green Cones and compost units so that householders have some economic investment in using them.

10. Acknowledgements

This research project could not have been carried out without the consistent participation of the 63 households and they are to be congratulated since the participant response rate was excellent over the 12 week research period.

Green Cone www.greencone.com contributed far more Green Cones than they initially agreed and without this contribution the research could not have been completed.

The ECOLINC Co-ordinator Mary Duncan was of especial help in locating new volunteer households.

Steve Williamson at The Moray Council provided essential data to aid the statistical analysis and helpful advice when required.

Emily Nichols of the Composting Association provided many useful contacts to help trace similar studies with which to compare the results of Waste Away Phase 2.

List of following appendices in order:

Appendix 1: Reduction of green waste

Appendix 2. Green Cone leaflet

Appendix 3. Initial letter asking for volunteers

Appendix 4. 1st contact letter to potential volunteers

Appendix 5. Agreement form/copy

Appendix 6. Instruction sheet accompanying weight record sheets

Appendix 7: Questionnaire Survey Waste Away Scheme is it a success? October 1999

Appendix 8: Summary of base data form Waste Away Phase 2 research

Appendix 9 Data extracted from MEL survey

Appendix 10. Comparison of 3 composting systems

The Waste Away Scheme Phase 2.

A quantitative survey of the effectiveness of The Moray Council's waste minimisation scheme to reduce organic kitchen food waste going to landfill.

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