SMALL WORLD CONSULTING

The carbon impacts of choices with the body after death: four scenarios

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1. Introduction

1.1 This report

This report sets out to provide information on the carbon impact of common choices with the body after death and to contribute to the public engagement and education aims of The Corpse Project.

We look at four scenarios for disposing of the body. Carbon burdens for each are calculated based on the total carbon emissions over a five-year period. This includes elements such as the coffin, travel by mourners, and fuel use for burning and site maintenance. The five-year time scale allows for a more comprehensive understanding of the impacts of each scenario.

The complexity of supply chains is such that all GHG emissions estimates contain a degree of uncertainty. The results of this analysis are also highly dependent on the assumptions made within each scenario. However, we have confidence that this report identifies at least in broad terms the most and least significant components of the footprint of the four funeral choices and can serve as a guide to the issues.

Clearly, the carbon footprint of each option is very small compared to the lifetime carbon footprint of a person, and equally clearly, there are many other important considerations when planning a funeral. However, the occasions we assess in this report are times of reflection at which great symbolic importance can be attached to small actions. Positive environmental decisions therefore have the potential to make statements about life values and to have influence far exceeding their direct impact.

1.2 The Scenarios

1.2.1 Low-impact field burial with a private landowner

There was assumed to be an average distance of 40 km to travel for each for to get to the site. This is intended to reflect the relative remoteness of this funeral option. In the first year after the burial the site is assumed to be visited four times and for the four subsequent years once annually. No additional maintenance is thought to be required as the land would be otherwise used as grazing or grassland. The coffin is constructed from cardboard, as is commonly the case for this type of funeral.

1.2.2 Human pyre

The average distance travelled to reach the site of the human pyre is assumed to be 30 km and there is no return to the site by relatives. 150 kg of wood fuel is used. We have assumed that this has been collected locally but would otherwise be used to replace domestic fossil fuel.. No site maintenance is required in this scenario and there is a cotton shroud used.

1.2.3 Woodland burial

Mourners travel, on average, 30 km to the funeral site. In the first year after the burial the site is visited four times and for the four subsequent years once annually. One additional tree would is planted per burial. The coffin is made from cardboard. No site maintenance is required as forestry would occur with or without the funeral.

1.2.4 Cremation

This scenario incurs an average of 20 km distance to the site with no subsequent return to the site by relatives. The smaller distance reflects the ubiquity of crematoria. Site maintenance includes the electricity and heating of the building and cremation itself which is gas fired. The coffin is constructed from chipboard.

1.2.5 Further assumptions that are generic to all four scenarios

The four scenarios each assumed an attendance of 50 mourners to the funeral with travel to and from the site assumed to be by car with average UK emissions and with an average car occupancy rate of 3 persons per vehicle. The service was assumed to be the same for each scenario and the carbon burden of the service was assumed to be minimal.

2 Results

2.1 Overview

Mourners' travel is the most significant carbon burden in all four scenarios analysed accounting for up to 98% of the total carbon burden of a scenario The varying total carbon emissions reflects the remoteness of each option – the more remote a location the further one must travel to attend the funeral and therefore the higher the carbon burden. The fuel used for cremation or pyre can account for up to 42% of a carbon burden and thus is also a significant source.

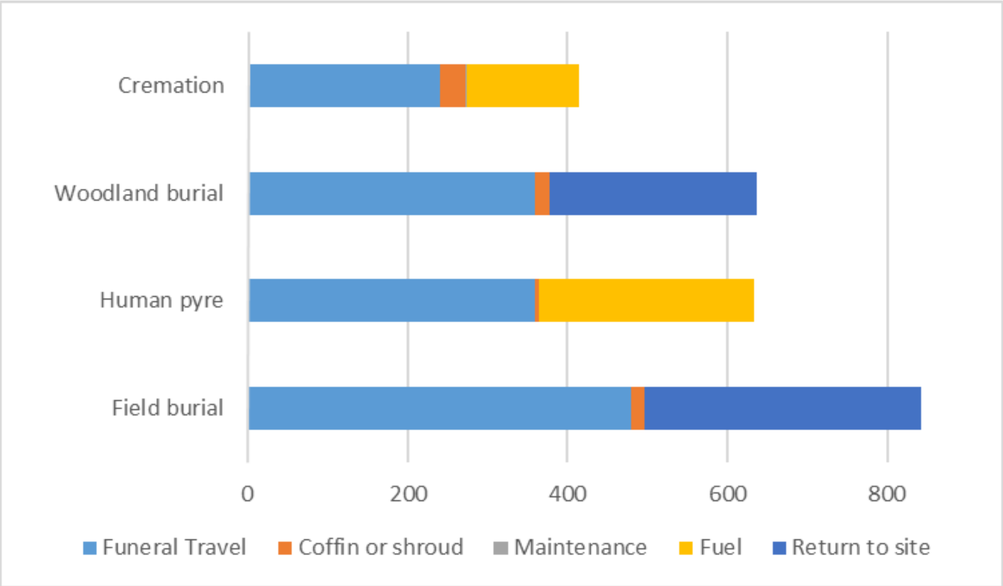

Figure 1: Breakdown of the total carbon dioxide equivalent burden of each scenario in kg

2.2 Field burial with private landowner

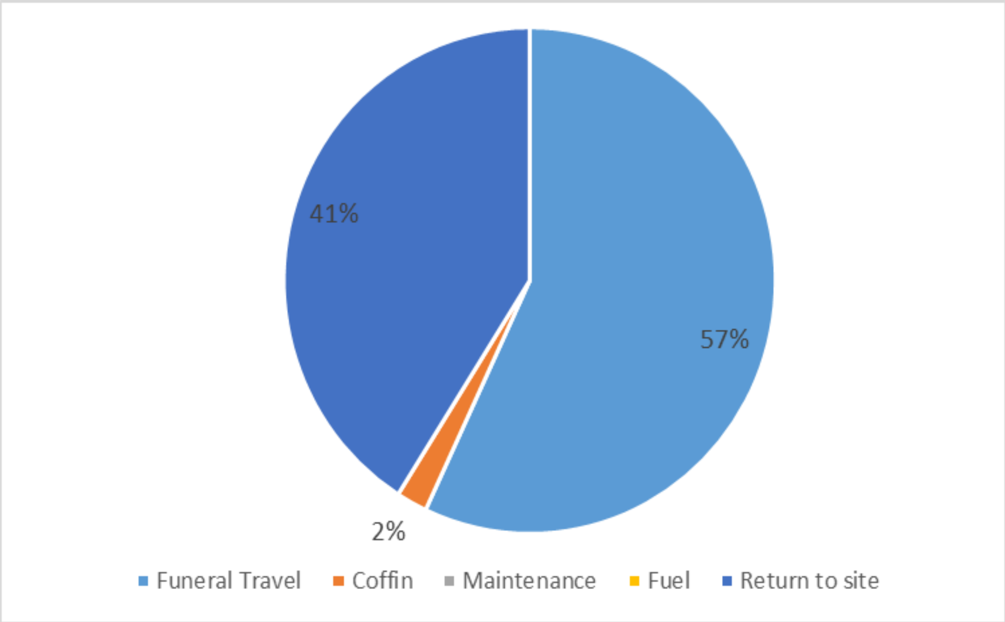

Figure 2: Detailed composition of the carbon footprint of a low-impact field burial; 843 kg CO_2e

For a field burial the source of 98% of the carbon burden is travel by mourners, of which over half the resulting carbon is emitted due to returning to the site post-burial. The remaining 2% of the carbon burden is attributable to the cardboard coffin. There is no contribution of fuel or site maintenance to the carbon burden. Though there is unlikely to be any significant soil pollution due to this burial (or the woodland burial) as the bodies are not treated with any preservatives as in a conventional burial, however there will be some release of methane of the decomposition of the bodies, though this calculation was beyond the scope of this study.

Were return visits to the site of the burial removed, the full carbon burden of this scenario would reduce to 497 kg CO_2e, reducing the total carbon footprint by 41%. This shows the significance of carbon emissions from travel in these scenarios.

2.3 Human Pyre

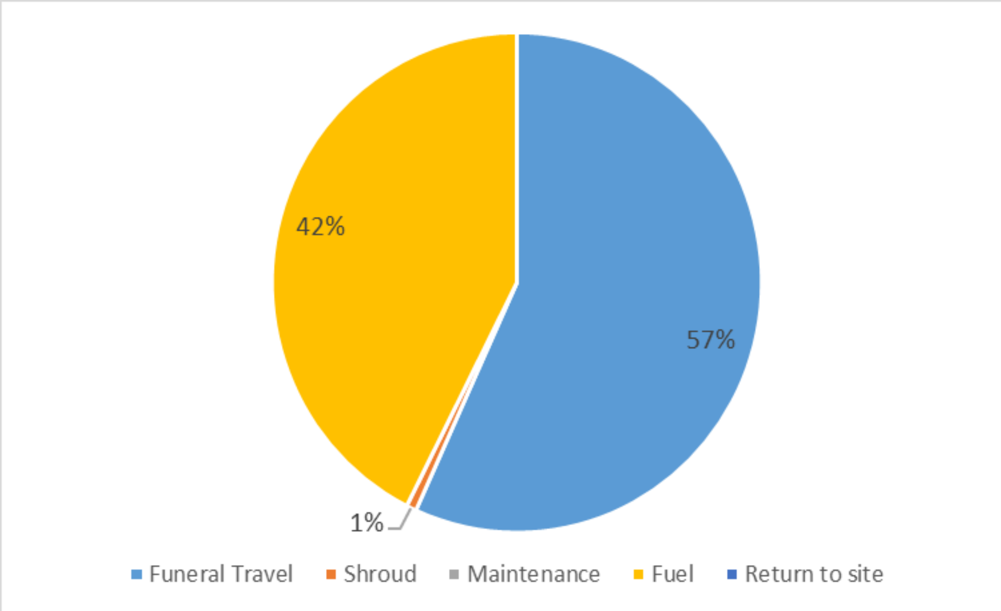

Figure 3: Detailed composition of the carbon footprint of a human pyre; 634 kg CO_2e

Some may argue that waste wood is a carbon neutral fuel source as the carbon released equates to the carbon taken up by the tree during its lifetime. However if this wood fuel can be burned on a pyre it could also be used to heat a home, cook food, or power a combined heat and power unit, displacing fossil fuel. For this reason, the carbon released on the burning of the waste wood has been attributed to the pyre's carbon burden and makes up 42% of the total carbon burden. The remainder of the carbon burden is emitted, predominantly through travel to the funeral. As such, despite the lower travel induced compared to the burial options, the human pyre is the second most carbon intensive option evaluated in this report.

As well as the carbon burden of a human pyre it should be noted that they cause particulate pollution that can be significant in urban areas or areas that are over-used for pyres.

2.4 Woodland Burial

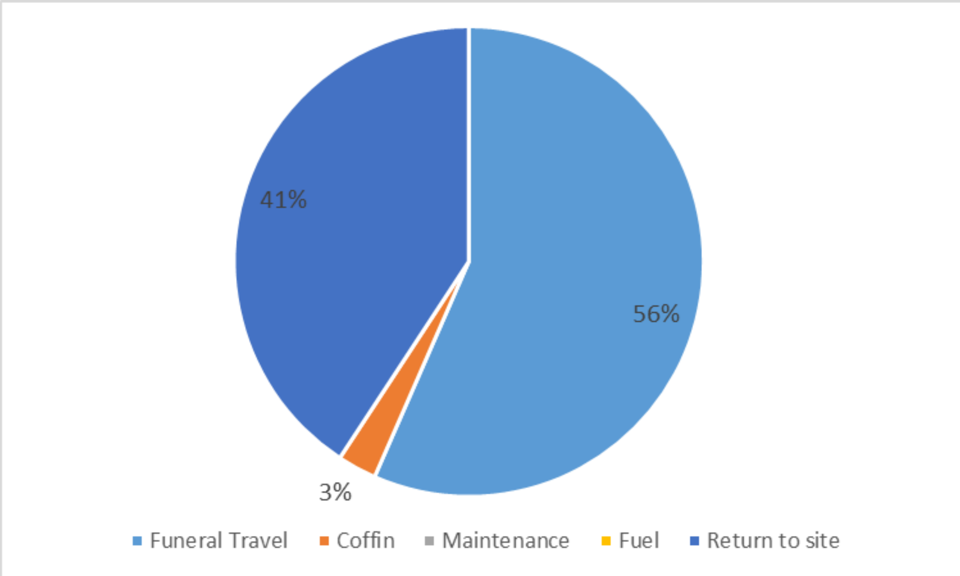

Figure 4: Detailed composition of the carbon footprint of a woodland burial; 636 kg CO2e

In carbon terms, the significant difference between a woodland burial and a low-impact private landowner burial in our scenarios is the distance travelled. Travel is again the most important carbon burden contribution, however the decreased distance to woodland burial sites reflects the comparative closeness of these sites and therefore the decreased carbon burden from transport, which results in 206 kg CO_2e less carbon burden for a woodland burial than with a private land owner. If no relatives returned to the site the carbon burden of a woodland burial would decrease to 377 kg CO_2e and this would then become the least carbon heavy scenario, showing the influence of the carbon burden of travel in this situation.

A tree sequesters roughly 2 kg carbon dioxide per year which, over the five-year scope of this study, could potentially reduce the carbon burden of a woodland burial to 626 kg CO_2e, however this is dependent on being able to prove additionality and permanence of the carbon offset and this is sometimes problematic. Thus, and because the total amount of carbon saved is small, we have not included the impact of planting a tree in the total carbon burden of the scenario.

2.5 Cremation

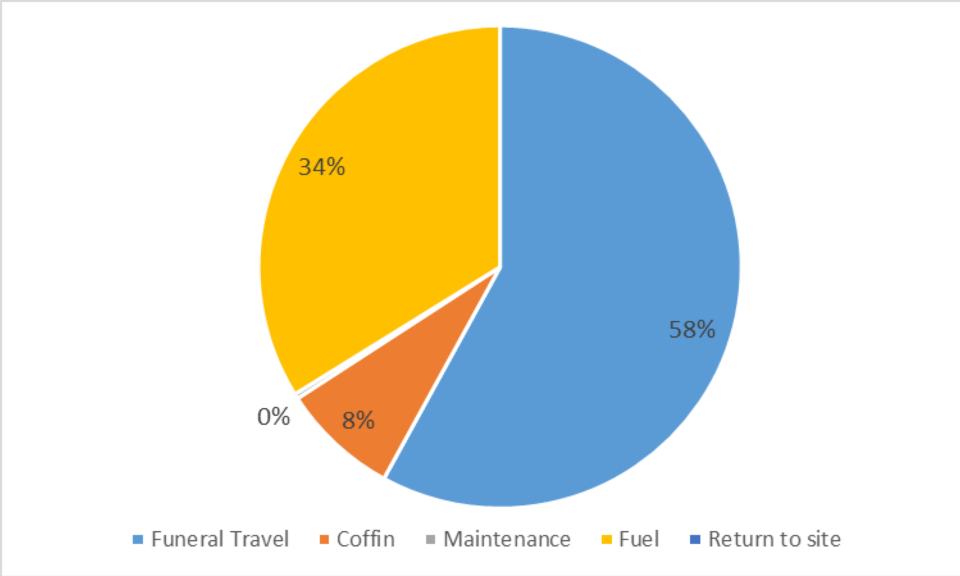

Figure 5: Detailed composition of the carbon footprint of a cremation; 414 kg CO_2e

Overall cremation is the option with the lowest total carbon burden due to the shorter distances travelled by mourners, that there is no return to site, and the lower carbon burden of the fuel used during the process. While the fuel for cremations has a lower carbon burden than that for a human pyre it is still significant, the source of 140 kg CO_2e. Transport and fuel are the most significant carbon contributors, however the chipboard coffin has almost three times the carbon footprint of the cardboard coffin that has been assumed in the other scenarios. The maintenance of the site has been calculated for the duration of the cremation only for use in this analysis, however there is some controversy regarding the inefficiencies of running crematoria which should be kept in mind. Maintenance analysed in this way accounts for less than 1% of the carbon burden of the cremation scenario and is therefore largely insignificant in the assessment of the environmental impact of cremation.

Aside from carbon, cremation also releases mercury pollution which poses health risks relating to fertility, the brain and the nervous system. Recently the government has introduced measures to reduce the emissions of mercury form crematoria and they are significantly improved, however with continued cremation comes continued pollution and the reduction of mercury pollution has induced an overall increase in the fuel used during cremations.

2.6 Scenarios without travel burden

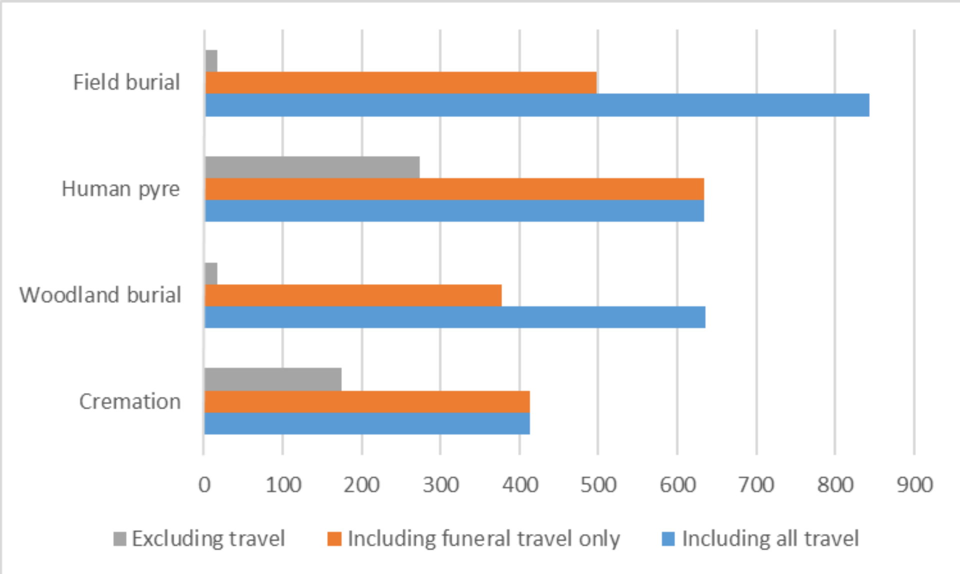

Figure 6: Detailed comparison of scenarios with differing travel arrangements.

With no return to site travel the scenario with the lowest carbon burden is the woodland burial, though it is only slightly less carbon-heavy than cremation. When all travel, including to the funeral itself, was removed from the analysis the two burial options had the lowest carbon burdens, however this is an unlikely scenario given the personal significance of the funeral itself.

3 Conclusions

In terms of carbon burden over five years from the date of the funeral, our cremation scenario has the lowest burden on account of the low travel distance involved, the lack of return visits to the site and, compared to the pyre scenario, the efficiency of the burn. The carbon burden of cremation is less than half that of the most carbon-heavy scenario in this report which is private land burial. The difference is due to the increased distances involved and the post funeral site visits.

Travel was clearly the most influential factor in the carbon burden of all the funeral choices.

4 Methodology

This report deals with emissions from travel to and from funerals, repeat visits to sites, the burning of bodies, the production of coffins and site maintenance. All other factors are assumed to be either insignificant and / or the same for each scenario and therefore not justifying comparison.

Emissions factors have been used to quantify the carbon associated with units of each element of consumption. Where possible standard emissions factors supplied by Defra in 2015 have been used for this. However, in the case of car travel and fuel consumption, these do not take account of full fuel supply chains and such factors as the embodied emissions in the manufacture and maintenance of cars and roads. In order to take these into account, we have used emissions factors derived by Small World Consulting which use Defra's emissions factors as a start point and draw upon AA cost data and environmentally extended input output analysis to add the supply chain elements.

5 Appendix: Calculations and emissions factors

A carbon factor is defined in this report as the kilograms of carbon dioxide equivalent (kg CO_2e) emitted per unit of activity, for example the kg CO_2e emitted during one passenger kilometre, or in creating one kilogram of cardboard.

A carbon burden is the total amount of carbon dioxide equivalent emitted for a given situation or scenario, for example the kg CO_2e emitted by all passenger kilometres, or for creating an entire coffin out of cardboard.

5.1 Field burial with private landowner carbon calculations

Table 1: Detail of carbon factors and calculations of the carbon burden of a field burial with a private landowner.

	Transport to funeral (passenger km)	Fuel	Maintenance	Return to site total travel (passenger km)	Coffin (kg cardboard)	Total kg CO_2e
Specification (relevant units)	4000	n/a	n/a	960	12	
Carbon factor (kg CO_2e unit^{-1})	0.12			0.36	1.4	
Carbon burden (kg CO_2e)	480			345.6	17.1	**842.7**

5.2 Human pyre carbon calculation

Table 2: Detail of carbon factors and calculations of the carbon burden of a human pyre.

	Transport to funeral (passenger km)	Fuel (kg wood)	Maintenance	Return to site total travel (passenger km)	Shroud (kg cotton)	Total kg CO_2e
Specification (relevant units)	3000	150	n/a	n/a	0.6	
Carbon factor (kg CO_2e unit^{-1})	0.12	1.8			7	
Carbon burden (kg CO_2e)	360	270			4.2	**634.2**

5.3 Woodland burial carbon calculations

Table 3: Detail of the carbon factors and calculations of the carbon burden of a woodland burial.

	Transport to funeral (passenger km)	Fuel	Maintenance	Return to site total travel (passenger km)	Coffin (kg cardboard)	Total kg CO2e
Specification (relevant units)	3000	n/a	n/a	720	12	
Carbon factor (kg CO_2e units^{-1})	0.12			0.36	1.4	
Carbon burden (kg CO_2e)	360			259.2	17.1	**636.3**

5.4 Cremation carbon calculations

Table 4: Detail of the carbon factors and calculations of the carbon burden of a cremation.

	Transport to funeral (passenger km)	Fuel (kg gas)	Maintenance (hours of energy used)	Return to site total travel (passenger km)	Coffin (kg chipboard)	Total kg CO_2e
Specification (relevant units)	2000		2	n/a	80	
Carbon factor (kg CO_2e units^{-1})	0.12		0.68		0.41	
Carbon burden (kg CO_2e)	240	140	1.4		32.8	**414.2**