Carbon reduction report 2022

System boundary

The Marwell carbon footprint relates to the operations of Marwell Zoo in Hampshire. Included in scope are: scope 1 emissions from heating and on-site vehicles; scope 2 emissions from electricity consumption and scope 3 emissions from waste disposal and recycling, water & sewage and business travel including travel to in situ conservation programmes in other countries.

In country travel data for conservation programmes was not available for initial calculations but has been included for 2022. Data for other emissions at in situ locations such as heating, cooking and lighting are not yet available but will be included in later calculations when the data is available. Wider scope 3 emissions from the supply chain are also excluded at this stage but will be included as more data becomes available.

Baseline

Marwell started monitoring and measuring carbon emissions and other environmental impacts in 2008 as part of our ISO14001 environmental management system hence 2008 was chosen as the baseline year for assessing carbon reductions.

Carbon dioxide equivalents were calculated from annual monitoring data using DEFRA conversion figures published annually on www.gov.uk. When the 2008 carbon footprint was first calculated our baseline emissions were 1,562 tonnes CO_2e, however, the range of emissions included in scope 3 were later expanded to include electricity infrastructure losses and well to tank emissions for fossil fuels when this conversion data became available. The baseline was therefore recalculated to include the same scope 3 emissions which resulted in a 2008 emissions baseline of 1,706 tonnes CO_2e (Figure 1).

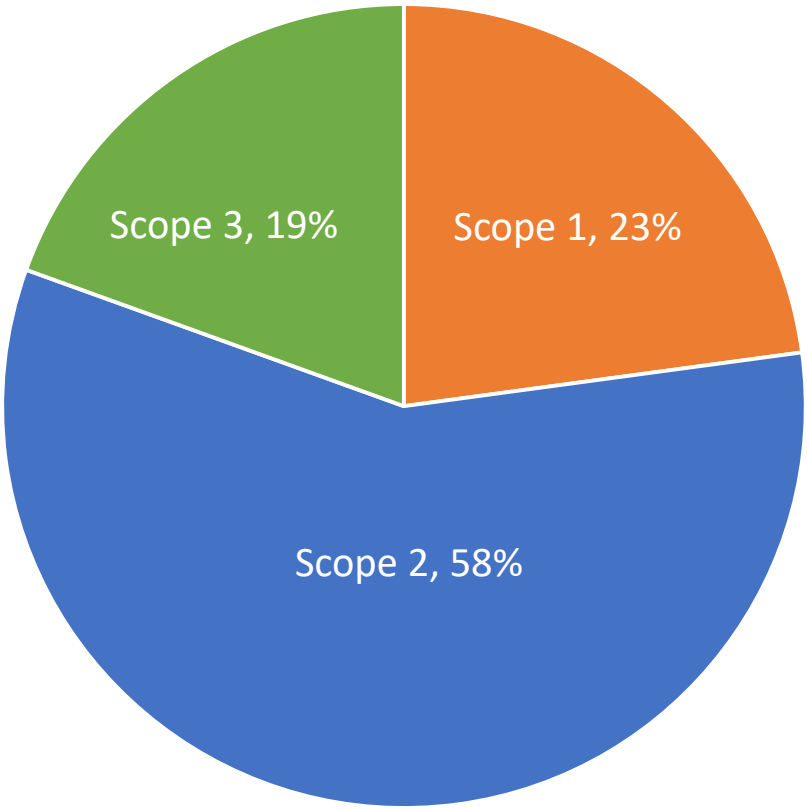

FIGURE 1 2008 BASELINE CARBON FOOTPRINT, 1,706 TONNES CO2E

Scope 1	Heating fuel (oil, kerosene and LPG)	296
	Site vehicles	94
	Fugitive refrigerant emissions	0
Scope 2	Electricity (1,982,216 kWh)	983
Scope 3	Electricity - national infrastructure losses	224
	Heating fuel WTT emissions	57
	Site vehicles WTT emissions	19
	Water and Sewage	13
	Waste and recycling	11
	Business travel	8

TABLE 1. 2008 CARBON FOOTPRINT, QUANTITIES IN TONNES CO_2E

Carbon reduction

Marwell initiated a carbon reduction strategy in 2012 which later became the Carbon Reduction Plan with a target of becoming carbon neutral by the end of the organisation's 50th anniversary year in 2022. Reductions in the largest sources of emissions were targeted through a mixture of efficiency gains, behaviour change, installation of renewable energy and purchasing renewable electricity.

Electricity

Electricity was the largest single source of carbon emissions so reducing this source of emissions was a priority.

Energy efficiency

Since 2008 Marwell has replaced light bulbs and fluorescent tubes with LEDs and timers, thermostats and sensor controls have also been installed on a variety of lighting and heating systems throughout the zoo. Buildings which were assessed to be particularly inefficient were identified for additional work. For example, solid wall insulation was installed to the interior of the reptile house in 2013 after thermal imaging revealed this to be a particularly inefficient building. Various larger animal houses have been modified to create warms zones within the larger buildings rather trying to heat the entire space where there is a need to have doors open permanently to allow animals access to outside spaces.

Onsite renewable electricity generation

In 2011 Marwell installed rooftop solar panels to the two largest buildings with south facing roofs: 29.9kWp installed on the Heart of Africa building; and 19.79kWp on the south Okapi building. Between these two installations nearly 50,000kWhs of electricity are generated each per year, reducing the total carbon footprint by around 20 tonnes CO_2e per year. Additional solar panels were installed at Fur Feathers and Scales in 2013 and on Wild Explorers in 2016 taking the total solar capacity to over 75kWh, generating 70,000kWh per year and increasing the carbon emission reduction to 29 tonnes CO_2e per year.

In 2021 another 94kWp of solar generating capacity was installed in partnership with Winchester City Council across three roofs under a power purchase agreement. Solar panels at Marwell now generate over 150,000kWh of electricity each year.

When Café Graze opened in 2008, despite this being designed as a highly efficient facility, the café added around 200,000kWhs to our annual electricity consumption. Overall however the total consumption has reduced 15% since the café opened, a net reduction of 25% from the combination of energy efficiency savings and the solar installations.

Electricity sourcing

In 2014 Marwell switched electricity contracts to buy only renewable electricity. Carbon emissions from electricity consumption are therefore reported using the 'location and market based' methods. Location-based emissions are the carbon emissions from grid average

electricity available at the specific location while market-based emissions include any reduction in emissions resulting from purchasing lower or zero emission electricity. Marwell chooses electricity contracts from suppliers guaranteeing zero carbon emissions.

Heating fuel

Marwell has over 100 buildings across the zoo of varying sizes. The majority of the smaller animal houses use electric infrared spot heaters and small bar heaters which offer the best compromise between energy efficiency and animal welfare, creating warm areas when doors have to be left open to allow animals continuous access to outside spaces. The infrared heaters create hot spots which warm the animals rather than the air reducing the amount of heat lost through the open doors.

Larger buildings, however, continue to be heated by fossil fuel boilers and have been targeted for action. The former Tropical World exhibit was built in 1995 as a traditional single glazed glasshouse heated by large oil boilers and was the largest single source of carbon emissions at the zoo. When the old Tropical World was decommissioned and replaced with the much larger “Energy for Life” Tropical House in 2018 it was an opportunity to create an energy efficient space that was heated by renewable energy. Energy for Life: Tropical House has five times the volume of the former Tropical World it replaced but uses half as much energy to heat. That heat is generated from renewable woodchip biomass from local sustainable sources. Heating Energy for Life with biomass reduced carbon emissions by 100 tonnes CO_2e per year compared to the previous Tropical World.

Nearby to the new Tropical House were several other buildings which were also heated by fossil fuels: Marwell Hall, Okapi house, Curators cottage and Life in the Trees. Together these buildings contribute another 100 tonnes CO_2e to the annual carbon footprint so, rather than creating individual solutions for each building, it was decided to create a heat network to connect all of these buildings to the single sustainable heat source. Marwell has a steady supply of animal bedding and manure coming from the larger animals which was potentially a valuable fuel source. Manure from some animals was too wet to be used as fuel (Hippo, Tapir, Rhino) but others produced dry straw-based manure which was ideal to process into fuel briquettes. The result was the Energy Centre which sits behind Energy for Life and takes manure from a range of animals including giraffe, zebra, somali wild ass and scimitar horned oryx to produce heat. The animal manure boiler produces around 320kW of heat output compared to 200kW from the woodchip boiler. The woodchip boiler supplies heat to the network during less cold periods in Spring and Autumn and the larger animal waste boiler provides the heat in the colder periods. In coldest periods both boilers operate together to ensure both animals and staff are warm and comfortable whatever the weather.

The full heat network came online at the end of 2022 and we greatly anticipate the full carbon reduction from the project being assessed and reported at the end of 2023.

Vehicles

Marwell has used electric golf buggy type vehicles for many years to move staff and small equipment around site, but larger diesel vans and agricultural machinery are needed for larger

jobs. Changes to working practices, reducing the distance travelled in diesel vehicles, reducing the number of vehicles and choosing more efficient vehicles when replacements are needed have all contributed to reducing consumption of diesel fuel. Since 2008 the carbon emissions of site vehicles reduced from 113 tonnes CO_2e to 63 tonnes, a reduction of 45%.

2022 Carbon footprint

Since the change to purchasing electricity on a renewable energy tariff Marwell calculates both a market-based carbon footprint, which records electricity as zero carbon, and a location based calculation which uses a grid average carbon intensity from the DEFRA / DESNZ / BEIS.

Following the changes implemented under the carbon plan Marwell Wildlife's carbon footprint for 2022 was 497 tonnes CO_2e (market based), 71% reduction from the baseline year (Figure 2). The small amount of scope 2 emissions in 2022 (19 tonnes) was caused by our electricity supplier failing to secure sufficient renewable energy during the energy crisis which followed the Russian war in Ukraine.

For 2022 greenhouse gas emissions not included in scopes 1, 2 & 3 are reported for completeness. These emissions are referred to as 'emissions outside of scopes' under the Greenhouse Gas Protocol and are considered as having net zero carbon. The emissions result from the combustion of biogenic sources such as woodchip and the biofuel content of petrol and diesel. Under the protocol these emissions are counted as net zero for carbon equivalent reporting because the same amount of carbon is absorbed during the growth of the biomass as is emitted on combustion. There was none of this type of emission in the 2008 baseline year.

Market based calculation

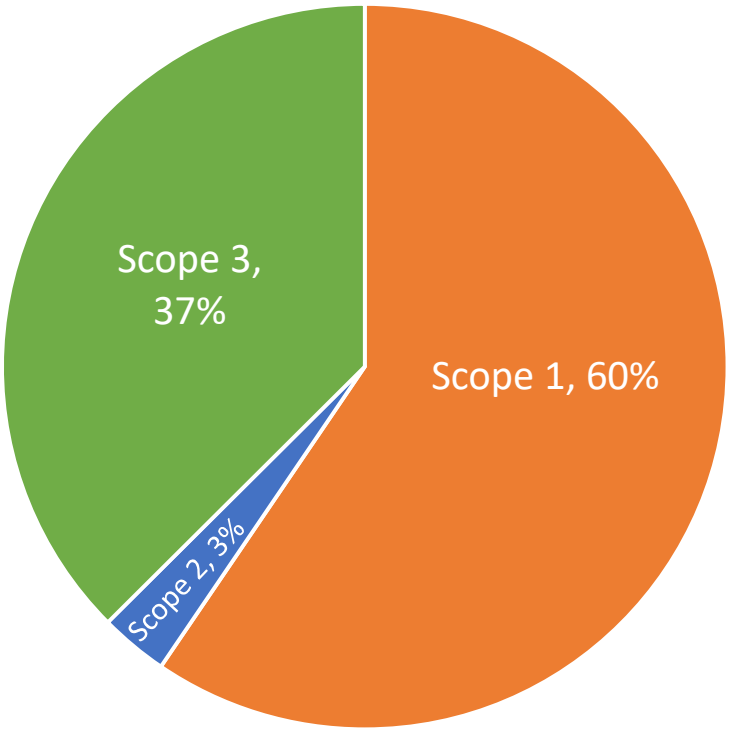

Figure 2 2022 carbon footprint, 497 tonnes CO_2e

Scope 1	Heating fuel	319
	Site vehicles	51
	Fugitive refrigerant emissions	0
Scope 2	Electricity – renewable source (1,584,296kWh)	0
	Electricity – non renewable source (97,408kWh)	19
Scope 3	Heating fuel WTT emissions	65
	Site vehicles WTT emissions	12
	Business travel - international teams	10
	Waste	9
	Business travel - UK based staff	8
	Electricity - national infrastructure losses	7
	Sewage	4
	Water	3
Outside of scopes	Biogenic content of fuels	430

TABLE 2. 2022 CARBON FOOTPRINT - MARKET BASED. QUANTITIES IN TONNES CO_2E

Location based calculation

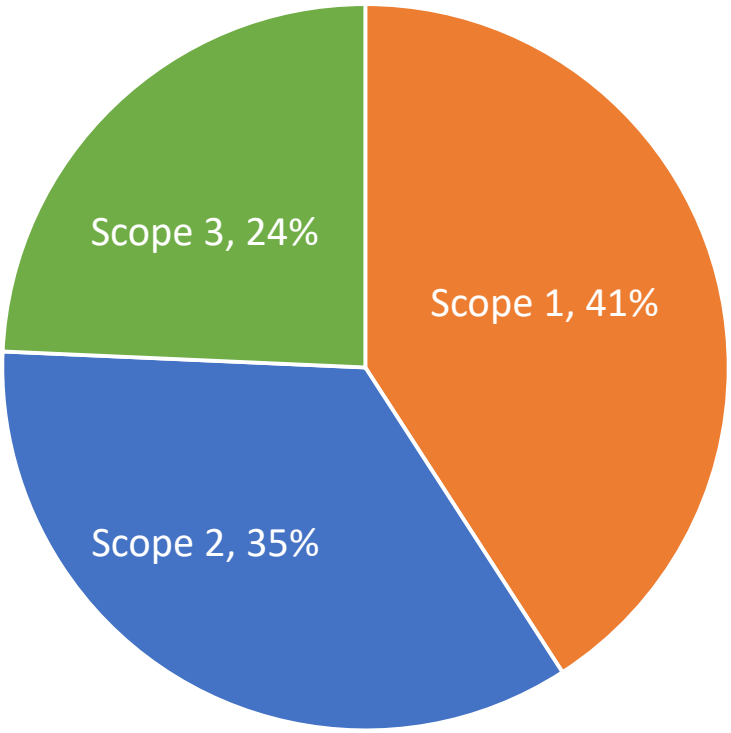

FIGURE 3. 2022 CARBON FOOTPRINT, 905 TONNES CO_2E

Scope 1	Heating fuel	319
	Site vehicles	51
	Fugitive refrigerant emissions	0
Scope 2	Electricity (1,681,704kWh)	315
Scope 3	Heating fuel WTT emissions	65
	Site vehicles WTT emissions	12
	Business travel - international teams	10
	Waste	9
	Business travel - UK based staff	8
	Electricity - national infrastructure losses	7
	Sewage	4
	Water	3
Outside of scopes	Biogenic content of fuels	430

TABLE 3. 2022 CARBON FOOTPRINT - LOCATION BASED. QUANTITIES IN TONNES CO_2E

Carbon removal

Marwell's estate covers 87 hectares including both the zoo and surrounding woodland and pasture. Marwell have been gradually restoring the semi-natural ancient woodland and planting additional trees on the field to the south of the zoo and within the zoo itself. In 2021 alone around 7,000 new trees were planted within the zoo. The managed woodland, new tree planting and grassland all absorb carbon from the atmosphere. Altogether this sequesters 547 tonnes CO_2 per year. Subtracting this carbon removal from the carbon footprint for 2022 results in emissions of -50 tonnes CO_2e, i.e. the Marwell estate removed 50 tonnes more CO_2 from the air than the total combined emissions included in the carbon footprint calculation.

Next steps - scope 3 and Net positive

Marwell already has plans to replace fossil fuel heating and cooking in the remaining buildings as part of the current carbon reduction plan.

Since Marwell first measured their carbon footprint and set a carbon neutral target the global concentration of carbon dioxide in the atmosphere has gone from 385ppm in 2008 to nearly 415ppm today. At the same time the impacts of climate change have been become ever more apparent with increased intensity of storms, rainfall, heatwaves and drought happening now, not at some point in the future. The world came together in Paris 2015 and recognised that much greater action was needed and Net Zero Carbon became the de facto target for the world. A net zero target includes not only an organisation's own emissions but also the emissions resulting from the production of goods and materials in the supply chain and the emissions from products sold (Figure 4).

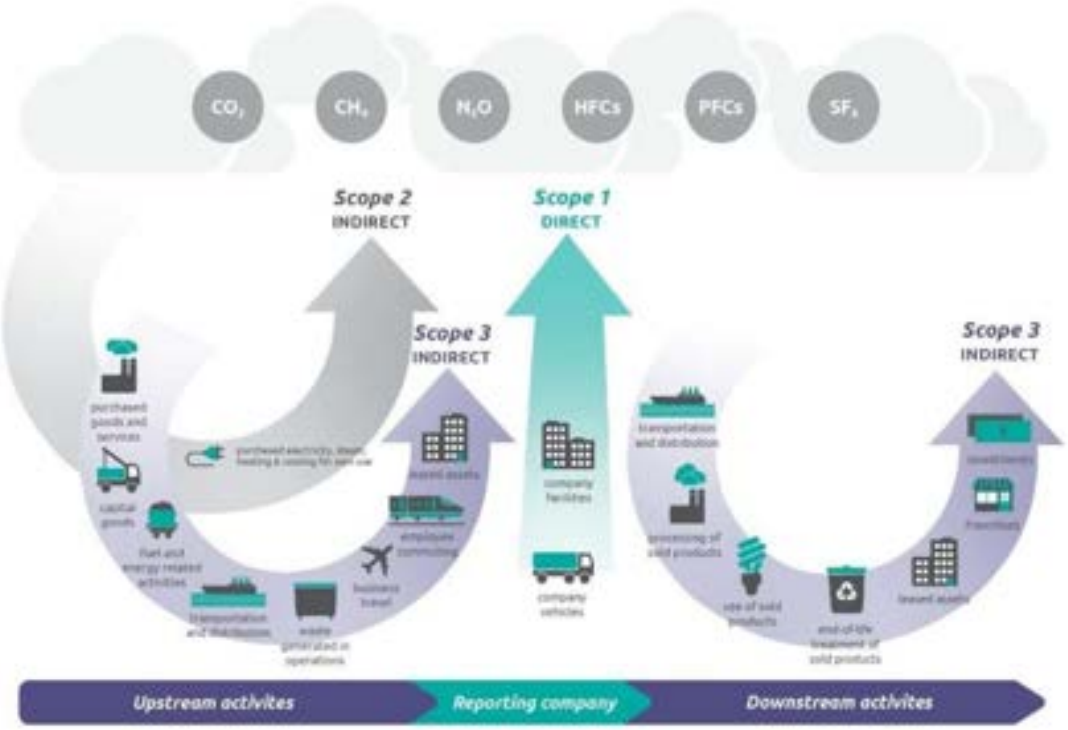

FIGURE 4 ILLUSTRATION OF SCOPE 3 CARBON EMISSIONS REPRODUCED FROM GREENHOUSE GAS PROTOCOL

Marwell is starting the process of measuring emissions from the supply chain and are aware that these are likely to be higher than the sum of the scope 1 & 2 emissions measured so far. Supply chain emissions are already starting to reduce through the application of the ethical sourcing policy. For example, in the 2019 (last year of trading before the pandemic) Marwell sold 63,241 soft toys with an estimated carbon footprint of 49 tonnes CO_2e. The soft toys range is now almost exclusively made from recycled plastic. For the same number of toys sold the footprint would have been only 17 tonnes CO_2e, a 65% reduction in emissions.

This year Marwell hopes to complete an initial scoping exercise to estimate the total carbon footprint encompassing scopes 1, 2 & 3 according to the Greenhouse gas protocol.

Marwell will set a Net Zero target later this year (2023) and intends to surpass net zero to become carbon positive at which point our activities will remove more carbon from the atmosphere than is emitted by ourselves and our supply chain.

Beyond carbon net zero

Climate change and carbon emissions are not the only threats facing humanity and global biodiversity. Deforestation and land use change, soil degradation, freshwater availability, air pollution and ocean acidification are just a few of the threats to biodiversity and our ability to

feed the growing global population. At the same time inequality and injustice blights the lives of millions around the world and puts further pressure on nature as people living in poverty struggle to provide for themselves and their families. Marwell is therefore working on plans to become not just carbon positive but to have a net positive impact socially, environmentally, and economically. To achieve this, we will be looking closely at not just the impacts of what we do but also the unintended consequences for people and the planet. This will include Marwell zoo, our conservation activities, the impacts of our supply chain and our influence on guests, businesses, other zoos, governments, and anyone else we come into contact with. A net positive organisation is one who's actions contribute to recovering habitats and ecosystems, support the wellbeing of the people and communities in its supply chain whilst continuing to invest in its own product, staff and local community.