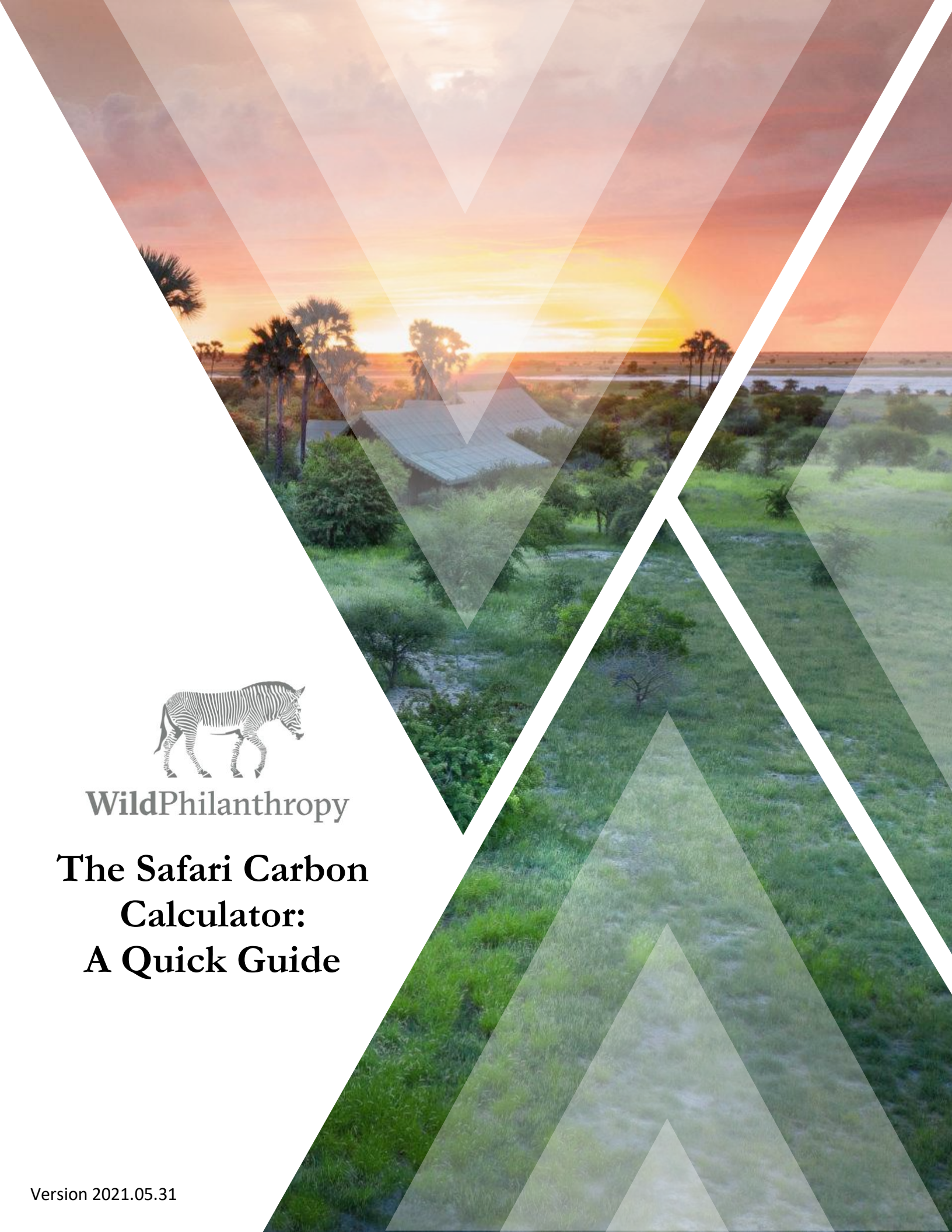

WildPhilanthropy

The Safari Carbon Calculator: A Quick Guide

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Table of Contents

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Introduction to the Safari Carbon Calculator

The Safari Carbon Calculator is an MS Excel-based tool designed to calculate the cost of offsetting the carbon footprint of bespoke safari packages. The tool allows safari tour operators to quickly and easily calculate the carbon dioxide equivalent (CO_2e) emissions produced during a safari package and the cost of offsetting those emissions. To do so, users answer a series of questions related to the types of transportation and accommodation used during the safari, as well as the current price of carbon. While every effort was made to design the calculator using best-available information, it is important to note that the methodology is not an exact science; there are several educated assumptions embedded in the calculator where precise data was not available, all of which are detailed in this guide. However, all background calculations and parameters are fully customizable, which allows the user to update the calculator if/when new information becomes available.

Using the Calculator

Before using the calculator for the first time, **it is highly recommended to save a "clean" version of the spreadsheet in a safe location,** including a backup version in a zip folder for added protection. Because the calculator contains many internal cell references and formatting rules, if the spreadsheet becomes corrupted (which happens from time to time with Excel), it will be much simpler to start with a clean version rather than trying to locate and fix the error. **It is also recommended to save a new version of the calculator for each safari package**. This not only ensures that a record is kept for future reference, but also minimizes the risk of user errors, which are more likely to occur if modifications are made to a version that is already filled in with information. To facilitate this, both the client name and safari destination can be captured directly in the calculator.

The calculator is made up of two worksheets named "Questions" and "Calculations". The former contains all the questions that the user needs to answer for the calculator to function, whereas the latter contains all the background calculations and parameters. To minimize the risk of accidental user error, both worksheets are password protected. **If changes need to be made to the calculator, the password for both worksheets is "wilderness"**. Unless the calculator parameters need to be updated, users only need to input information in the Questions worksheet. To do so, follow the instructions in each yellow cell. Once a question is answered, the next relevant question will appear below. For questions 2 – 10, the yellow cells require an answer of either "Yes" or "No". If you answer Yes, the cell will turn green, and a series of sub-questions will appear to capture the relevant details required to calculate the CO_2e emissions for that component of the safari. If you answer no, the cell will turn red, the sub-questions will be skipped, and the next relevant question will appear. Once all the questions are answered, the total CO_2e emissions (tonnes) and cost of offsetting (currency of choice – see below) will appear below the final question (rows 38 and 39).

The Calculator Components

The following sections describe each of the 10 components used to calculate the CO_2e emissions produced by a bespoke safari package and the cost of offsetting those emissions. For each component, a description is provided, including the source of each of the equation parameters.

1. Carbon Pricing

The carbon pricing component is used to calculate and report the total cost of offsetting the safari package CO_2e emissions. Once questions 2-10 are answered, the calculator simply converts the total kg of CO_2e into metric tonnes and multiplies this value by the price per tonne. For this component to function correctly, question 1 requires two pieces of information:

- Price per tonne of CO_2e: This is inputted by the user as either a whole or decimal number.
- Currency that the price is expressed in: This is inputted by the user from a drop-down list of the most commonly used ISO 4217 Currency Codes:

Currency	Code
British pound	GBP
Euro	EUR
US Dollor	USD
Swiss Franc	CHF
Canadian Dollar	CAD
Australian Dollar	AUD
Indian Rupee	INR
Singapore Dollar	SGD
Malaysian Ringgit	MYR
Japanese Yen	JPY
Chinese Yuan Renminbi	CNY

2. International and Domestic Flights

Total kilograms of CO_2e emissions from international and domestic flights is calculated as the product of:

- Number of passengers: This is inputted by the user as a whole number.

- Kg of CO_2e emitted per passenger kilometer: This is a fixed value of 0.20515 kg CO_2e per passenger kilometer, which was taken from the Santa Clara University Carbon Footprint Calculator[1].

- Total distance flown (km): The total distance between airports is calculated using the haversine formula[2], which uses latitude and longitude coordinates to calculate the great-circle distance (km) between any two points on earth. The calculator links airport IATA codes to airport lat/long coordinates using the airport database downloaded from OpenFlights[3]. The user can include up to 11 flights by inputting the number of stopovers (whole number between 0 and 10, with 0 representing a direct flight) and the 3-letter IATA

code of the airport that each flight leaves "From" and arrives "To". The calculator then sums the total distance of across all flights to determine the total distance flown.

- Uplift Factor: The uplift factor is a fixed, unitless value of 1.08, which is a standard multiplier used to account for additional flight CO_2e emissions related to take-off, landing, circling, and non-direct routes (e.g., redirected due to a storm)[4].

3. Lodge Accommodation

Total kilograms of CO_2e emissions from lodge accommodation is calculated as the product of:

- Number of guests: This is inputted by the user as a whole number.
- Number of nights per guest: This is inputted by the user as a whole number.
- Kg of CO_2e emitted per guest night: This is a fixed value of 31 kg of CO_2e per guest night, which was taken from the Chalmers University of Technology Travel and Climate Calculator[5]. This value is a rough estimation of the average CO_2 emissions produced by hotels across several countries outside Europe and North America.

4. Mobile Camp Accommodation

Total kilograms of CO_2e emissions from mobile camp accommodation is calculated as the product of:

- Number of guests: This is inputted by the user as a whole number.
- Number of nights per guest: This is inputted by the user as a whole number.
- Kg of CO_2e emitted per guest night: This is a fixed value of 7.8 kg of CO_2e per guest night, which was taken from the Chalmers University of Technology Travel and Climate Calculator[6]. This value is a rough estimation of the average CO_2 emissions produced by "lower climate impact" accommodations based on average values derived from several countries outside Europe and North America.

5. Private Plane Charters

Total kilograms of CO_2e emissions from private plane charters is calculated as the product of:

- Total number of flying hours: This is inputted by the user as a whole or decimal number.
- Gallons of fuel used per hour of flying: This value represents the fuel consumption of the specific charter plane model used during the safari. From the drop-down list in the calculator, users can choose from several commonly used models or select "Unknown", which takes an average of all the fuel consumption values:

Plane Model	Gallons fuel / hr	Source
Cessna 182	14.0	[7]
Cessna 206	17.0	[8]

Plane Model	Gallons fuel / hr	Source
Cessna 208	68.0	[9]
Cessna 208B	50.0	[10]
King Air 200	106.0	[11]
King Air 350	122.0	[12]
Beechcraft C90	70.0	[13]
Challenger 350	300.0	[14]
Lear 45	198.0	[15]
Pilatus PC-12	70.2	[16]

- Kg of CO_2e per gallon of fuel: This is a fixed value of 9.57 kg CO_2e per gallon of fuel used, which is the standard conversion for jet fuel[17].

6. Helicopter Charters

Total kilograms of CO_2e emissions from helicopter charters is calculated as the product of:

- Number of helicopters: This is inputted by the user as a whole number.

- Total number of flying hours per helicopter: This is inputted by the user as a whole or decimal number.

- Gallons of fuel used per hour of flying: This value represents the fuel consumption of the specific helicopter model used during the safari. From the drop-down list in the calculator, users can choose from several commonly used models or select "Unknown", which takes an average of all the fuel consumption values:

Plane Model	Gallons fuel / hr	Source
Eurocopter B3	45.0	[18]
Eurocopter B4	54.0	[19]
Bell 206 Jet Ranger	30.0	[20]
Airbus H125	42.3	[21]
Airbus H130	55.0	[22]

- Kg of CO_2e per gallon of fuel: This is a fixed value of 9.57 kg CO_2e per gallon of fuel used, which is the standard conversion for jet fuel[23].

7. 4x4 Vehicle Transport

Total kilograms of CO_2e emissions from 4x4 vehicle transport is calculated as the product of:

- Number of vehicles used: This is inputted by the user as a whole number.

- Total number of hours driven per vehicle: This is inputted by the user as a whole or decimal number.

- Average speed per vehicle (km/hr): This is a fixed value of 20 km per hour, which is the assumed average driving speed during a safari[24].

- Kg of CO_2e emitted per km driven: This is a fixed value of 0.35396 kg CO_2e per km driven, which was taken from the Santa Clara University Carbon Footprint Calculator (converted from miles to km for an SUV/truck)[25].

8. Quad Transport

Total kilograms of CO_2e emissions from quad transport is calculated as the product of:

- Number of quads used: This is inputted by the user as a whole number.

- Total number of hours driven per quad: This is inputted by the user as a whole or decimal number.

- Average speed per quad (km/hr): This is a fixed value of 20 km per hour, which is the assumed average driving speed during a safari[26].

- Kg of CO_2e emitted per km driven: This is a fixed value of 0.1020573 kg CO_2e per km driven, which was taken from the Carbon Footprint Calculator as the equivalent of a large motorcycle (>500cc)[27].

9. Boat Transport

Total kilograms of CO_2e emissions from boat transport is calculated as the product of:

- Number of boats used: This is inputted by the user as a whole number.

- Total number of hours per boat: This is inputted by the user as a whole or decimal number.

- Gallons of fuel used per hour of boating: This is a fixed value of 1.5 gallons per hour, where the horsepower of a small outboard motor (max of 15 horsepower)[28] is divided by 10 to calculate the average fuel consumption in gallons per hour[29].

- Kg of CO_2e emitted per gallon of fuel: This is a fixed value of 8.89 kg CO_2e per gallon of fuel used, which is the standard conversion for gasoline[30].

10. Hot Air Balloon Transport

Total kilograms of CO_2e emissions from hot air balloon transport is calculated as the product of:

- Number of hot air balloons: This is inputted by the user as a whole number.

- Total number of hours per balloon: This is inputted by the user as a whole or decimal number.

- Kg of CO_2e emitted per hour of flying: This is a fixed value of 120 kg of CO_2e per hour of flying, which was taken from the Bailey Balloons Environmental Policy statement[31].

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