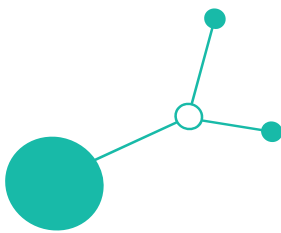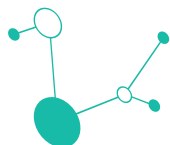Innovative participatory sustainable business model for cycling along the Iron Curtain Trail - Innovative ICTr Cycling

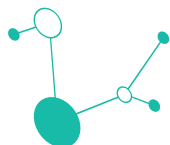# REPORT: EVALUATION AND ADAPTION THE FOOTPRINT CALCULATOR TO THE ICTR PRODUCT - D.2.2.1

5. Version, final
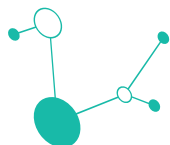
08 2024

CROST Nonprofit Ltd.

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Executive summary

The ICTr project will develop the ICTr Good Impact programme, which was preceded by the Project Partners' task to collect carbon footprint calculators that measure the amount of CO_2 emitted by tourism. The distribution and evaluation of the collected calculators according to the criteria recommended by the literature and relevant to the project was carried out by the CROST team. The distribution of the calculators is as follows:

- 81.3% of the calculators are capable of assessing the CO_2 emissions from different transport modes or combinations of modes for a journey from home to destination;

- more than a third of the calculators collected do not give the possibility to check the accommodation, 31.3% evaluate it by type of accommodation;

- of the calculators collected, most measure only the CO_2 emissions of different vehicles, and mostly separately;

- the vast majority of the calculators collected (75%) do not give any offsetting options;

- the selected calculators are primarily available via a web interface;

- half of the calculators are not applicable to the Iron Curtain Trail, as there is no option to select e-bike or bicycle for transport modes;

- 81.3% of calculators are not directly related to cycling, however, 50% of the calculators selected by Partners also offer the possibility to calculate the carbon footprint of cycling;

- 37.5% of the calculators collected take into account a person's dietary habits in their calculations;

- additional information is in most cases linked to the accommodation;

- 56.3% of the calculators use data from a single country;

- 43.8% of the calculators can only measure the carbon footprint of a single vehicle over a given distance

The collected calculators were evaluated in two ways. Heat index tables were created to display qualitative and comparative information for each calculator. Each calculator was rated high, medium or low in each category, indicating the extent to which the calculator collected input data. The most relevant aspects of the project (e.g. Travel between home and the destination, Accommodation, Mobility within the destination, Additional information) were then selected to determine which calculators were most suitable for the ICTr project.

As a result of the analysis, two calculators (Ecological Footprint Calculated with the Sustainable Process Index and Carmacal) were found to meet the project's requirements. The functioning, results and differences between the two calculators will be presented through several specific packages in order to give Partners a complete picture of the calculators selected by the CROST team.

Foreword

Elements of the CO2 footprint calculator in the ICTr project

Aim of this project activity is to provide an impact measurement system for climate neutral travel, tailored to the project. The developed system should calculate carbon footprint caused by the products developed in the project, which also serves as basis for the valorisation programme established for nature conservation and community development. The calculator is also a communication tool: it serves the promotion of the newly developed packages to the wider audience, justifying their climate-neutral nature.

The carbon footprint calculator shall be developed in the following stages, according to the AF:

- A2.1: analysing the existing climate neutral travel solutions: collect information and review the existing tools. Related deliverable: D.2.1.1 Analysis of the existing climate neutral travel solutions.
- A2.2: Evaluation and adaptation of the footprint calculator to the ICTr product: transfer of relevant elements from the available calculators (A2.1) to the system developed by Trail Angels. Related deliverable: D.2.2.1 Upgraded and optimised environmental footprint calculator for ICTr.
- A2.3: Developing the impact measurement system and integrating the environmental footprint calculator: the integrated system will be able to measure the actual footprint, integrated into the booking system. Related deliverable: D.2.3.1 Concept of impact measurement system considering ecological, economic and social aspects of tourism.
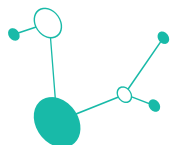
The above-written activities will be followed by the testing of the newly developed system and elaboration of the ICTr Good Impact Programme.

Introduction

The Partners of the ICTr project have collected 16 different calculators. The key issue in tourism footprint research is how to define the analytical framework.

Today, a much more complex framework is used than in previous periods. At the beginning, researchers worked with only a few data, but the number of factors to be analysed has steadily increased over time. The first analytical framework for **T**ouristic **E**cological **F**ootprint (TEF) was developed by Gössling, which included four components: tourism transport, accommodation, leisure activities and food consumption. (Gössling et al, 2002)

Related to this, Patterson, Peeters and Schouten found that tourism transport should include two segments. (Patterson et al., 2007; Peeters and Schouten, 2006) One is the transport from origin to destination and the other is local transport. The specification of tourism transport plays an important role in estimating the tourism footprint at national, regional and local scales. Today, seven factors are considered for a relatively scientific measurement of the **TEF**, which includes tourism transport, accommodation, catering, shopping, entertainment, sightseeing and waste disposal.

The evaluation of the footprint calculators by reviewing of existing solutions

In our case a standard set of indices and evaluation categories were used to qualitatively score each calculator's depth of inputs. These criteria have been developed on the basis of a literature review of the carbon calculator and factors relevant to the project. In the framework of the project, we mainly want to measure the carbon footprint of tourism, so the criteria we have chosen are closer to the criteria defined by Gössling with the difference that we have taken into account the reliability of the calculators, their usability and the way they display the results. The indices and evaluation categories are listed below:
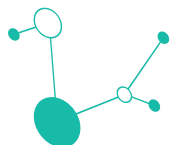
Depth of inputs:
- Travel between home and the destination
- Accommodation
- Mobility within the destination
- Offsetting
- Cycling relation
- Applicability to the Iron Curtain Trail
- Dietary habits
- Additional information
- Mobile app and/or online tool

User engagement:
- Dataset by data accuracy, reliability
- Ease of use: the individual calculations are added together, therefore a whole trip can be calculated in one
- Takeaway of information: emission values shown for each category, report display, final value display

First, we will examine the distribution of the collected calculators within the categories we have defined, and the depth of information available for each calculator within the criteria. We then analyse which calculators are most applicable to the project.

The calculators that we consider appropriate for the ICTr project are tested on three complete packages that we have put together to show the advantages and disadvantages of the calculators and the information content provided by each calculator. This will give Partners the opportunity to evaluate which of our proposed calculators they think is the most appropriate for their project.

Examination of the collected calculators

What options does the calculator offer for travelling between home and destination?
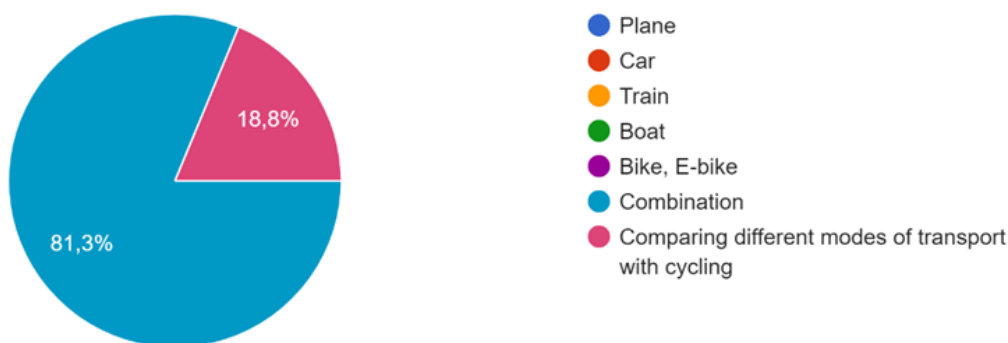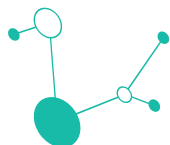
Of the calculators collected by partners, 81.3% are capable of assessing the CO_2 emissions from different transport modes or combinations of modes for a journey from home to destination. However, 18.8% of the calculators only show how much less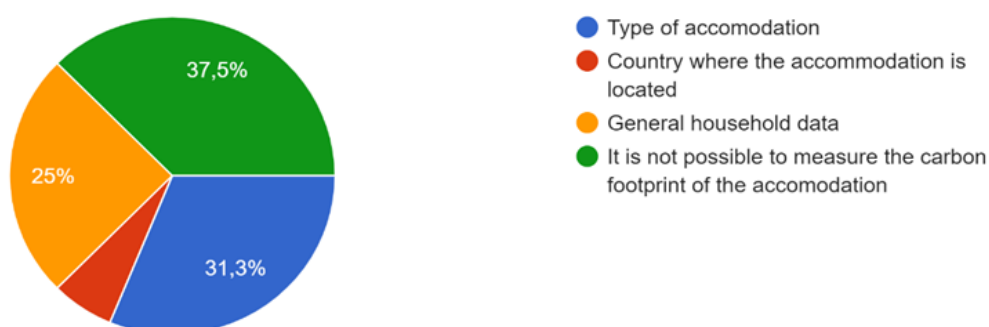 CO_2 we emit if we choose to cycle instead of a given mode of transport (car-bus-train). The most ideal calculator for the project is the one that includes the most different modes of transport, including e-bike and/or bicycle.

Is it possible to measure the carbon footprint of the accommodation, and if so, what is the basis for this measurement?

More than a third of the calculators collected do not give the possibility to check the accommodation, 31.3% evaluate it by type of accommodation, 25% calculate general household values and the remaining 6.2% only allow you to specify the country where the accommodation is located. The vast majority of calculators collected (62.5%) either do not provide the possibility to measure the carbon footprint of accommodation or measure the carbon footprint of a household in general. Those calculators that can measure the carbon footprint at least by type of accommodation are relevant for the project.

Is there any option to measure the footprint of the mobility within the destination?
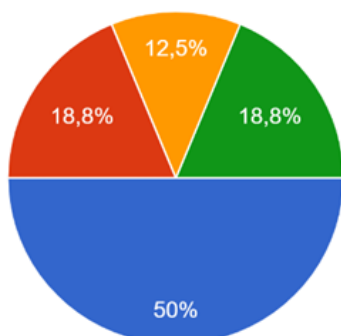
- ● No on-site mobility category, each mode of transport can be calculated separately
- ● There is only option to compare the cycling with different type of transport options
- ● Yes, the on-site mobility can be added separately to the measurement
- ● No, it is only a general household calculator
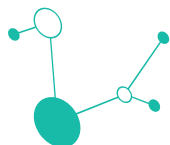
Of the calculators collected, most measure only the CO_2 emissions of different vehicles, and mostly separately. The household calculators focus on the average consumption of a household, while the calculators that focus on cycling only show the difference in emissions between cycling and other vehicles in a comparative way. However, there are two calculators (12,5%) among those collected where the elements of an entire trip can be added together, allowing trips made in a destination to be added to the calculation. Given the importance of the mobility within the destination for the project, these two calculators are the most suitable for us.

Is there any option for offsetting?
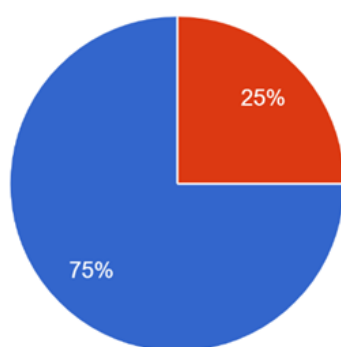
- ● No
- ● Yes

Offsetting is relevant when you not only want to know how much your carbon footprint was during a trip, but also want to do something to compensate for the "damage" caused by the trip. The vast majority of the calculators collected (75%) do not give any offsetting options. They can only be used for calculations.

In what format is the calculator available?
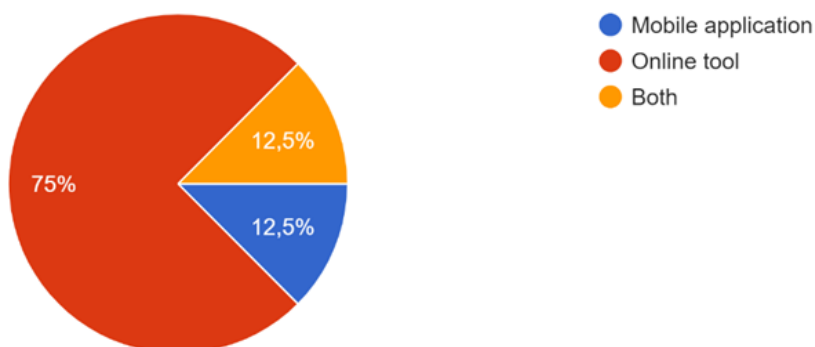
Only 12.5% of the calculators collected are available both online and through apps, and the same is true for the number of calculators available only through apps. This indicates that the selected calculators are primarily available via a web interface.

Is the footprint calculator applicable to the Iron Curtain Trail?
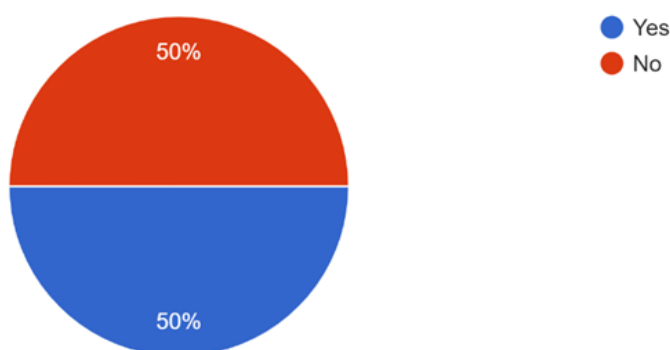
Half of the calculators are not applicable to the Iron Curtain Trail, as there is no option to select e-bike or bicycle for transport modes. As there is no possibility to add e-bikes or bikes in the calculators, these calculators cannot be used in the ICTr project. There are also calculators that use a category called "non-motorised" vehicle, but it is not clearly defined what kind of vehicle is meant.

Is this a cycling related footprint calculator?
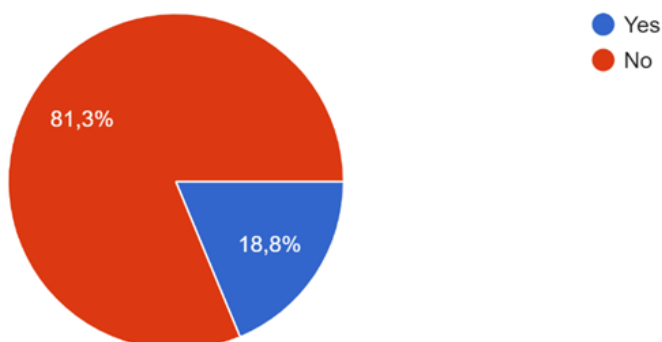
81.3% of calculators are not directly related to cycling. However, 50% of the calculators selected by Partners also offer the possibility to calculate the carbon footprint of cycling. In those cases where the calculator is specifically related to cycling, the other vehicles are shown for comparison purposes only.

Can dietary habits be added to the measurement?
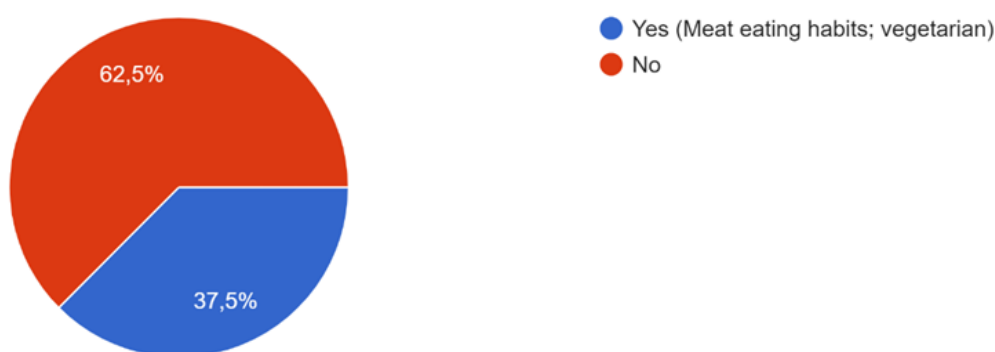
37.5% of the calculators collected take into account a person's dietary habits in their calculations, but in most cases they do not go beyond whether or not they are vegetarian. There is an option to include the extent of meat consumption habits in the calculations, but this is mostly the case for calculators measuring overall household consumption.

What kind of additional information can be added?
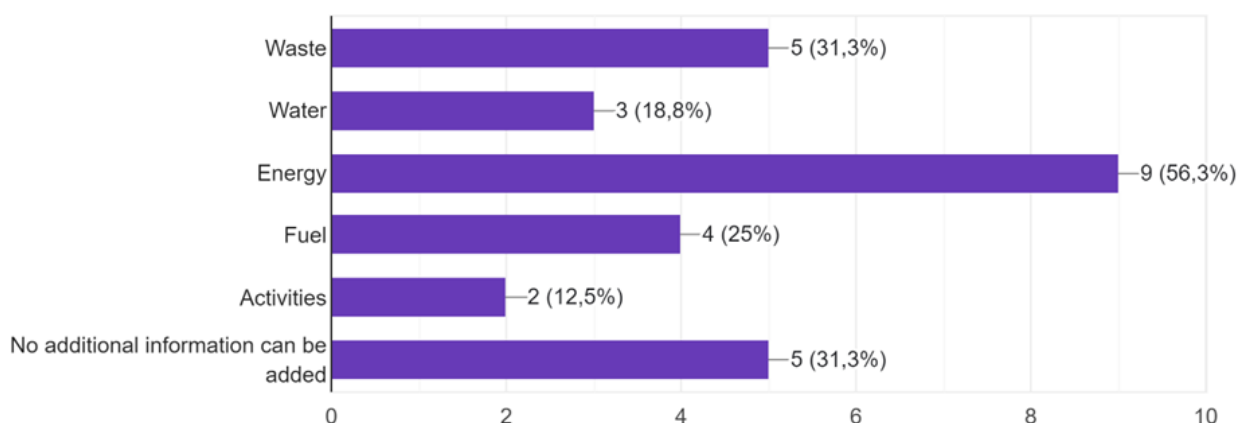
Additional information is in most cases linked to the accommodation. The calculators mainly measure water and energy consumption and waste management, but there are also some that look at the carbon footprint of visitors' activities. As information on the consumption of each accommodation is not always available, we can primarily measure the carbon footprint of the activities carried out by visitors.

What data the calculator uses for the calculation?
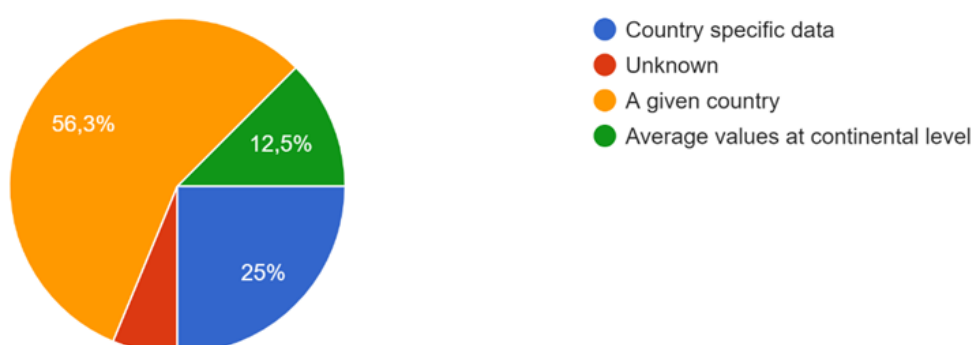
The origin of the data used for the calculations is very important for accuracy and reliability. The least reliable calculators are those that do not make it clear what data they use for their calculations. For all the calculators collected by Partners, the total number of such calculators is 6.2%. Most of the calculators use data from a single country (56.3%). 25% of the calculators have a country database and use data from the countries that are involved in the journey.

Is there any options to add up the calculations?
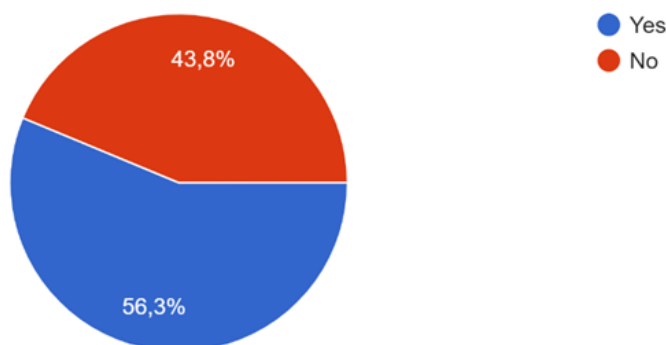
Some of the calculators collected look at everyday consumption patterns, so that individual consumption values are added together to give an aggregate figure for the household's carbon footprint. In addition, our list also includes some calculators specifically for holidays and travel. These are also able to handle multiple data simultaneously and give an aggregate figure for a given trip at the end of the calculation. However, some of the calculators (43.8%) can only measure the carbon footprint of a single vehicle over a given distance. For this project, the calculators to be considered are those that can handle the details of an entire trip in one go.

How the calculator communicates the results?
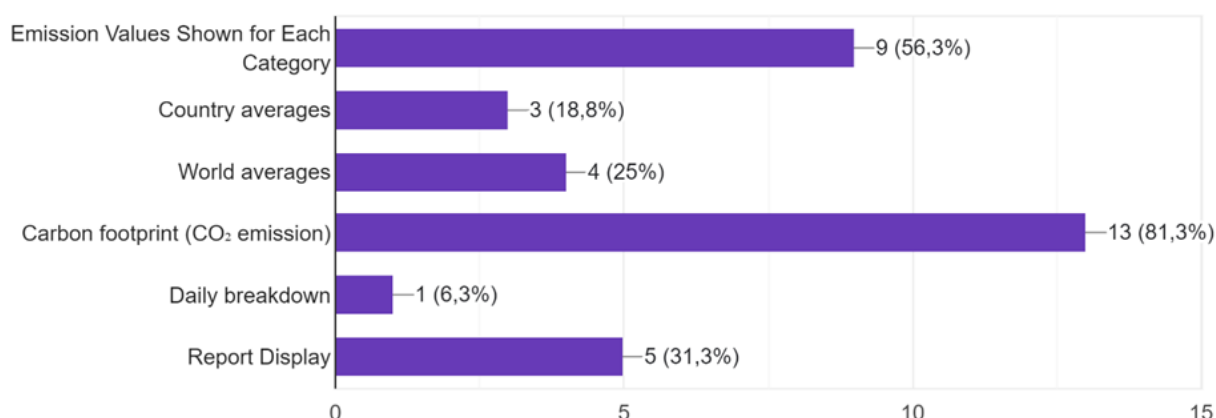
The reporting of results varies widely between the calculators collected. In many cases, the carbon footprint is reported for each emission category. In addition, some calculators compare the result to the national or world average, and some calculators display the result using charts and other visual elements.

Ranking of the collected calculators

For each of the 16 calculators, this study completed a full footprint assessment and recorded the details of calculator features in each of the evaluation categories. Heat index tables were created to display qualitative and comparative information about each calculator. Each calculator is given a High, Medium, or Low rating for each category, communicating the extent to which a calculator collected input data, communicated information, or engaged the user.

The colour coding is as follows: High = green, Medium = yellow, Low = red.

For the *„Travel between home and the destination"* category, a calculator that collects data for at least 5 major modes of transportation received a High rating, 3- 4 modes received a Medium rating, and 0-2 modes received a Low rating.

For *„Accommodation"*, a calculator that collects data on the type of the accommodation received a High Rating, a calculator that includes a general household data or the country of the accommodation received a Medium Rating, and no information on accommodation received a Low rating.

For the *„Mobility within the destination"* category, a calculator that collects data for at least 5 major modes of transportation received a High rating, 3- 4 modes received a Medium rating, and 0-2 modes received a Low rating.

In cases where a binary evaluation is conducted, only High and Low are used as evaluation markers. For example, in the *„Offsetting"*, *„Cycling relation"*, *„Applicability to the Iron Curtain Trail"* and the *„Summary of calculations"* categories a "Yes" equates to High or green or "No" equates to Low or red. The food category was also assessed according to this principle. If the calculator provided the possibility to enter data on *Dietary habits*, it was rated High or green, if not, it was rated Low or red.

One of the most important factors in the applicability of calculators is the *Database* they use for their calculations. This is important because different countries have different values for the criteria. Many of the calculators available for free use data from 1-2 countries, possibly using continental averages. However, there are also calculators that use country-level data, which makes their calculations much more accurate. Based on this, and similar to the previous assessment, calculators that use country-level data receive a High rating, those that use continental data or data from 1 specific country receive a Medium rating, and calculators that do not indicate the source of the data receive a Low rating.

For the *„Additional information"* section, 4-5 categories received a High Rating, 2-3 categories received a Medium Rating, and 0-1 categories received a Low Rating.

For the *„Mobile app and/or online tool"* section, category *both* received a High Rating, *mobile app* category received a Medium Rating, and the *online tool* category received a Low Rating.

The categories of comparison for the index *User engagement* was determined by the CROST team based on observations of the most useful methods for communicating calculator results.

From a user perspective, simplicity was also taken into account. For calculators, this means whether they *can handle all the details of an entire trip in one go*, or whether they

can only calculate the activities in parts and the user has to add them up manually to get a final value. The assessment is based on whether or not the calculator can handle a complete trip, even a trip of several days, in one go. In this way, similar to cases where a binary evaluation was done, only high and low values are included.

Finally, the *"Takeaway of information"* category was based on the need to communicate the meaning of the calculator results and motivate users to modify aspects of their carbon footprint. This category was not rated by the heat index, it is just an additional information to see, how much information can be gathered about our travel's effect by each of the calculators.

This graph shows the different activities that contribute to tourism's total carbon footprint.

Carbon Footprint of Global Tourism

6% Construction & Mining

1% Other

6% Lodging

8% Services

8% Agriculture

10% Food & Beverage

12% Goods

49% Transport
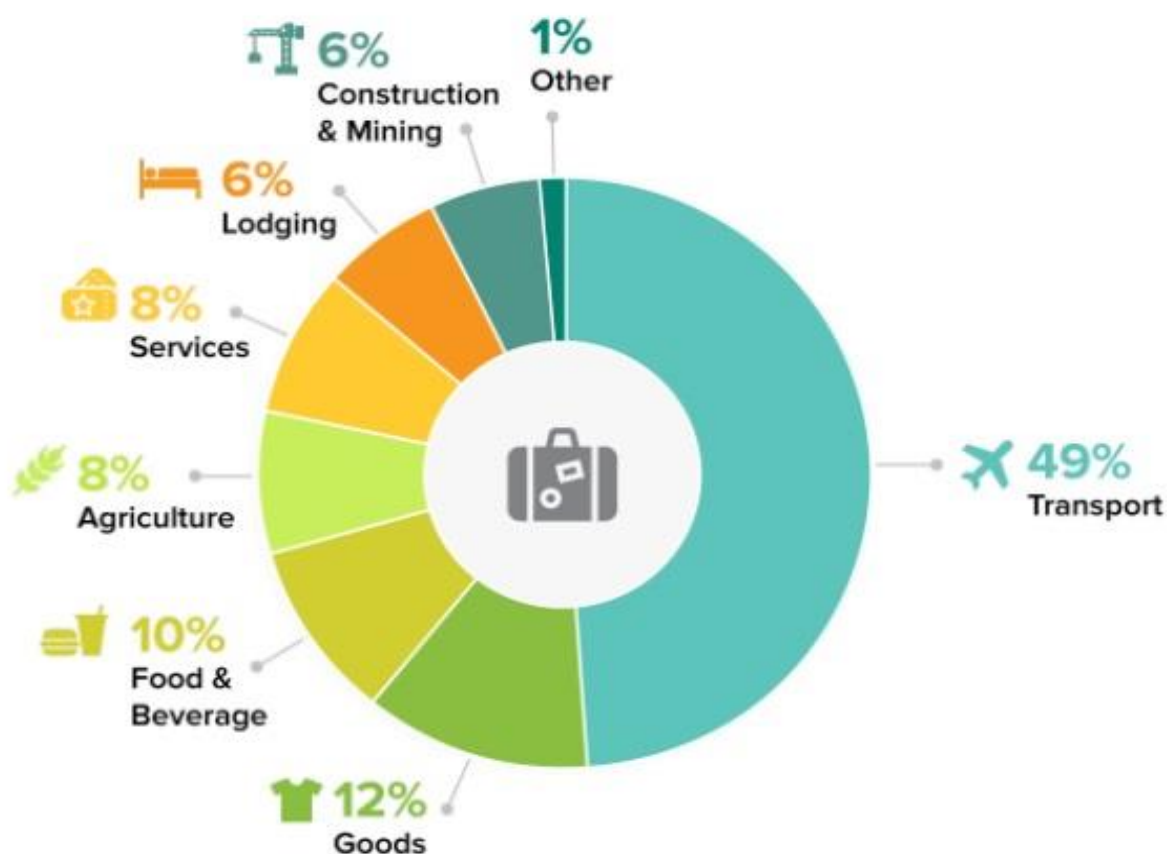
Data Source: Nature Climate Change (2018)
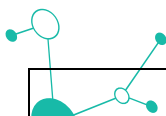
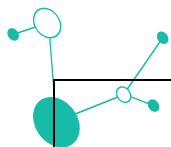| Name of the footprint calculator	Travel between home and the destination	Footprint of the accommodation	Mobility within the destination and the related services	Dietary habits	Specific environmental aspects, additional information	Is the footprint calculator applicable to the Iron Curtain Trail?	Is it a cycling related footprint calculator?	The footprint calculator has offsetting options	Mobile app and/or online tool	Database	Summary of calculations	Takeaway of information
Greentipper	Plane Car Boat (ferry, cruise) Train Tram Metro Bus Motorbike Electric bike	Type of accommodation	Plane Car Boat (ferry, cruise) Train Tram Metro Bus Motorbike Electric bike	not included	if the accomodation is not a hotel, additional information can be added, like gas, coal, fuel oil and electricity usage of the house	yes	no	yes	online tool	European average	No	Impact of your travel by plane Impact for the same distance when carpooling (per person) Impact for the same distance by train Annual budget per person to limit global warming
MOJECO2	Plane Car Public transport Motorbike Electric bike Non-motorised	Type of accommodation	Plane Car Public transport Motorbike Electric bike Non-motorised	meat eating habits/vegetarian	sport, pet, shopping and accomodation aspects can be added	yes	no	yes	online tool	Czech Republic	no	TOTAL ENERGY CONSUMPTION - kWh / trip TOTAL CARBON FOOTPRINT - kg CO_2 / trip ENERGY CONSUMPTION PER UNIT - Wh / km UNIT CARBON FOOTPRINT- g CO_2 /km
Carbon Footprint Calculator For Individuals And Households	Plane Car Motorbike	Household footprint - consumption of each type of energy can be added (min. time period is 1 week)	Car Motorbike Bus Train Metro Taxi	meat eating habits/vegetarian	Household: consumption of each type of energy The amount of spend for 13 different category (IT equipment, education, insurance, etc)	no	No	yes	online tool/mobile app	Country specific	yes	Your footprint is … tonnes per year The average footprint of Hungary's inhabitants is … tonnes European Union average 6.8 tonnes The world average carbon footprint is about 4.79 tonnes The world target for 2050 is 0 tonnes
EuroVelo Route Planner	compares different type of transport with cycling	not included	not included	not included	No additional information	yes	yes	no	online tool	European average	no	Saved kg CO_2

Tool	Transport								Tool type	Region		Results
Pomorze Zachodnie (The West Pomerania) mobile app	compares different type of transport with cycling	not included	not included	not included	No additional information	yes	yes	no	Mobile app and/or online tool	West Pomerania	no	Saved kg CO_2
Global footprint network - Ecological footprint	Car Motorcycle Plane	general household and consumption data	public transportation	meat eating habits/vegetarian	waste, energy, fuel, renewable sources	no	no	no	online tool	Country specific	yes	Your Ecological Footprint (global hectares or gha) Your Carbon Footprint (CO2 emissions in tonnes per year) Your Carbon Footprint (% of your total Ecological Footprint) Solutions
Cycle Seeing Atractour	Car Taxi Electric bicycle Bus	not included	not included	not included	energy, waste, water	no	no	no	online tool	no information	yes	Your ecological footprint is acceptable, within the average global hectare per person
WWF - How big is your environmental footprint?	Car Motorbike Public transport Train Bus Plane	general household and consumption data	not included	meat eating habits/vegetarian	waste, energy, fuel, shopping	no	no	no	online tool	UK/Ireland	yes	UK AVERAGE FOOTPRINT FOR 2023* YOUR FOOTPRINT IS … WORLD AVERAGE Breakdown: home, food, travel, stuff
Kalkulačka uhlíkovej stopy	Car Public transportation Train Plane	general household and consumption data	not included	meat eating habits/vegetarian	energy, waste	no	no	no	online tool	Slovakia	yes	Your total personal carbon footprint is … kilograms of CO2e per year. Your home carbon footprint … kg CO_2e Your transport carbon footprint … kg CO_2e Meals Consumption Lifestyle
Carbon Tracer	Train Car Bus Plane	not included	not included	not included	energy	no	no	no	online tool	EU/ Austria	no	CO$_2$ eq emissions per person (in kg) for a specific individual route for a specific means of transport.

Carmacal	Plane Car Boat Train Bus Motor Cycle Scooter Non-Motorized	exact accomodation data or type of accomodation	Plane Car Boat Train Bus Motor Cycle Scooter Non-motorized	not included	21 specific activities	yes	no	no	online tool	data from partner resources and proprietary datasets, country specific	yes	Carmacal has a pre-formatted report that shows the daily carbon emissions by day (Accommodation, Transport and Activities) specified by product element and by total usage.
TUCO2	Plane Boat Coach Car Train	Type of accommodation	Plane Boat Coach Car Train	not included	No additional information	no	no	yes	mobile app	UK	yes	Breakdown of CO_2 emissions per person and tripday, with global average
Cyclescheme	compares different type of transport with cycling	not included	not included	not included	No additional information	yes	yes	no	online tool	UK	no	CO_2 emissions saved per year: ... kg Equivalent of: ... trees
Ecotrip	Plane Public transport Car Bicycle Walking	not included	not included	not included	No additional information	yes	no	no	mobile application	Country specific	no	CO_2 emissions per vehicle
RADsite	Plane Car Taxi Rail Bus Ferry	Country of accommodation	Plane Car Taxi Rail Bus Ferry	not included	water, electricity, fuel	no	no	no	online tool	UK	yes	Breakdown of CO_2 emissions per category
Ecological Footprint Calculated with the Sustainable Process Index	Bicycle E-bike Scooter Motorcycle Car Caravan Bus Train Tramway Metro Plane Ship	Type of accommodation	Bicycle E-bike Scooter Motorcycle Car Caravan Bus Train Tramway Metro Plane Ship	meat eating habits/vegetarian	Activities (sauna, spa, segway)	yes	no	no	online tool	Austria	yes	The result shows the distribution of the environmental pollution as footprint and CO_2 in numbers. The diagrams show the distribution in percent. At the end you see a comparison of your holiday to the average all-year footprint in Austria.
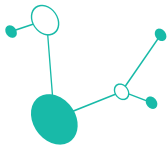
As the selected calculator must be tailored to the products developed in the project, it must cover the following elements/modules:

1.) Accommodation and the services it provides (food consumption),
2.) Mobility within destinations and related services (e.g. transport of luggage and bicycles between destinations).

1) Long distance travel between the emission market and the destinations of the packages
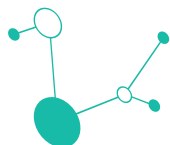
Depending on the exact target market of the single products, it is expected that a large share of the target group will arrive by private vehicles. Arrival by public transport should be promoted, taking into consideration major gateway cities along or near the route. In this latter category travel from gateway cities to the route must be also taken into consideration ("last mile"). Travel by plane is also expected to be relevant.

- Example among the revied existing tools:
  https://travelandclimate.org/;
  https://native.eco/for-individuals/calculators/#Travel
- For flights:
  https://www.iata.org/en/services/statistics/intelligence/co2-connect/iata-co2-connect-passenger-calculator/
- Various options are also provided by:
  https://www.carbonfootprint.com/calculator.aspx.

The most suitable calculators for the ICTr project are those that make CO_2 calculations for as many types of vehicles as possible between the origin and destination. However, there are some calculators that focus specifically on cycling and can therefore only be used to compare the difference in CO_2 emissions between a bicycle and another (usually optional) vehicle over a given distance. Given the importance for the ICTr project of the CO_2 emissions from the starting point to the destination in different types of vehicles, calculators that do not have the possibility to calculate CO_2 emissions over a given distance in different types of vehicles are not suitable to measure the emissions of a complete journey and therefore cannot be used for the implementation of the project. These calculators are as follows: *EuroVelo Route Planner, Pomorze Zachodnie (The West Pomerania) mobile app* and the *Cyclescheme*. In the heatmap, calculators that are green in the "Travel between home and the destination" column can measure the emissions of more than 5 different vehicles between the origin and destination, and are the most suitable for the project. Among the calculators collected, these are: *Greentipper, MOJECO2, WWF, Carmacal, TUCO2, Ecotrip, RADsite, Ecological Footprint Calculated with the Sustainable Process Index.*

2) Footprint of the accommodation and the related services

This primarily targets the accommodation facility itself, how it is equipped (energy use, insulation, waste production, water consumption etc.). Besides the facility itself it must take

into consideration the provided additional services such as meals (breakfast, half board), e-bike charging, wellness etc.

- Example among the reviewed existing tools: https://staze.com/
- Various options are also provided by
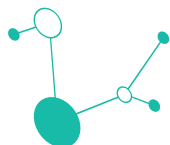 https://www.carbonfootprint.com/calculator.aspx

During the collection and evaluation of the calculators, it became clear that in most cases no such data is available for accommodation, and thus many calculators do not include a CO_2 calculation for accommodation. Those calculators that are capable of inputting and measuring consumption data for a property (water, gas, waste, etc.) are mainly used for general household calculations, not for travel. Neither the aforementioned nor the household calculators can be used to fulfil the task undertaken in ICTr projects. Among the calculators collected by the Partners are: *Carbon Footprint Calculator For Individuals And Households, EuroVelo Route Planner, Pomorze Zachodnie (The West Pomerania) mobile app, Global footprint network - Ecological footprint, Cycle Seeing Atractour, WWF - environmental footprint calculator, Kalkulačka uhlíkovej stopy, Carbon Tracer, Cyclescheme, Ecotrip.* However, among the calculators collected, there are also some that measure the CO_2 emissions of accommodation by type of property, and some that measure by the location of the accommodation rather than the type. Furthermore, the Partners have also found a calculator that has accurate data for specific types of accommodation. Calculators that can calculate a value by type, or possibly an exact value, are suitable for the project. These are the follows: *Greentipper, MOJECO2, Carmacal, TUCO2, Ecological Footprint Calculated with the Sustainable Process Index*.

For many calculators, it is possible to measure CO_2 emissions from dietary habits and other activities. In most cases, dietary habits are an indication of the extent of vegetarian/non-vegetarian or meat consumption habits. For other activities, the different calculators have a relatively wide range. The calculators that will be considered for adding dietary habits or other activities are those that meet the project's requirements in the first two points:

- **Greentipper:** it is not possible to enter data related to nutrition and instead of activity it is only possible to refine the consumption parameters of the accommodation,
- **MOJECO2:** meat consumption can be indicated or the vegetarian option can be selected, among the activities sport, pet, shopping and accommodation aspects can be added,
- **Carmacal:** it is not possible to enter data related to nutrition, but CO_2 emissions from 21 different activities can be measured,
- **TUCO2:** Neither dietary habits nor other activities can be added,
- **Ecological Footprint Calculated with the Sustainable Process Index:** meat consumption can be indicated or vegetarian option can be selected, other activities can be added to the calculation like sauna, spa and segway.

3) Footprint of mobility within the destination and the related services

This is a key element, given that the developed services will base on cycling, which is very positive from carbon footprint point of view. Therefore, development of this module is the real added value of the product. Besides cycling as primary mobility, transfer of bicycles, luggage, return transfer of tourists to the starting destination must be also taken into consideration.

- Inputs for calculating cycling and e-bike footprints:
  https://www.umweltbundesamt.de/themen/verkehr/nachhaltige-mobilitaet/
- Options for car transfer footprint: https://www.carbonfootprint.com/calculator.aspx.

Many of the calculators are primarily designed to measure the CO_2 emissions of a journey over a given distance in a given vehicle. In this way, the emissions of a journey on a destination can also be measured, similarly to the calculation of a journey between origin and destination.

The problem is that the above calculators can only do 1 calculation at a time, so the parts do not add up. So, for a multi-day trip, it would be relatively time-consuming to use these calculators to calculate the amount of CO_2 emitted during each trip, one by one.

Among the calculators collected by the project Partners, there are only 2 calculators that specifically take into account the CO_2 emissions of the journey/transport at the destination, and for these two calculators the individual calculations are also added together, so there is no need to calculate the journey from origin to destination and the trips made at the destination separately and then add them manually, as these two calculators can handle entire trips in one. These two are the "Carmacal" and the "Ecological Footprint Calculated with the Sustainable Process Index" calculators.

A presentation of the two selected calculators

Within the ICTr project, together with the Project Partners, we have been looking for calculators that can measure the carbon emissions of an active journey. In total, 16 different calculators were collected by the Partners and analysed by the CROST team from several points of view (based on the literature and the ICTr project's priorities).
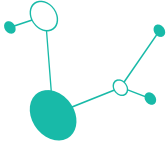
The distribution of the calculators according to specific aspects was presented and the "depth" of the data content of each aspect was analysed through a so-called heat map.

Then, the most relevant aspects for the ICTr project (travel from home to the destination, accommodation and other services, and transport in the destination) were used to see which of the calculators collected best met the task undertaken in the project.

As a result of the analysis, the CROST team identified two calculators that can be used to measure the carbon footprint of a whole trip **("Carmacal"** and the **"Ecological Footprint Calculated with the Sustainable Process Index"**). To present the two calculators, three packages was analysed with both of them, showing the results and the differences, advantages and disadvantages between the calculators.

Based on the analysis, the CROST team recommends that the Project Partners choose one of the two calculators selected, which they consider to be the most appropriate for the tasks undertaken in the project. The evaluation of the three packages, with the two calculators, can be found in the annexes.

There is considerable variation between the results of the two calculators. The reason is that while ***Carmacal focuses on the CO_2 emissions generated during the journey, Ecological Footprint Calculated with the Sustainable Process Index looks at the whole life cycle of a product/service and calculates its total ecological footprint.***

The calculation method used by the Ecological Footprint Calculated with the Sustainable Process Index is the so-called SPI, or Sustainable Process Index, developed by Krotscheck and Narodoslawsky. The Sustainable Process Index is calculated under the assumption that a sustainable economy is based on solar radiation as a natural income. According to the theory, most processes that can be observed on the earth's surface are driven by this radiation, and in order to convert this radiation into products and services, surface area is needed. Given that surface is a limited resource in a sustainable economy, area is therefore an appropriate measure of SPI, as the more area a process needs to deliver a service, the more it 'costs' in terms of ecological sustainability. [Krotscheck, C., M. Narodoslawsky, 1996]

Human activities affect the environment in different ways. The creation of each good requires resources, energy, labour and land, and in addition to the intended goods, they also produce emissions and waste. As a consequence, SPI includes all these different aspects of ecological pressures on the environment. The SPI calculation method devised by Krotscheck and Narodoslawsky is based on the total Atot area required to sustainably embed human activities in the ecosphere, which can be calculated as follows:

$$A_{tot} = A_R + A_E + A_I + A_S + A_P \quad [m^2]$$

On the right-hand side of the equation are the subplots for the effects of different production aspects. AR represents the area needed to produce raw materials, AE the area needed to produce process energy, including electricity, AI the area needed to provide the facilities for the process, AS the area needed to support the personnel, and AP the area needed to sustainably discharge emissions and waste products into the ecosphere.

The equation includes two elements whose values require preliminary calculations. These are:

$$A_R = A_{RR} + A_{RF} + A_{RN} \qquad [m^2]$$

$$A_I = A_{ID} + A_{II} \qquad [m^2]$$

The A_R is the sum of the areas needed to produce the renewable resource (A_{RR}), the fossil resource (A_{RF}) and the non-renewable resource (A_{RN}).

A_I is the sum of the area of direct land use (A_{ID}) and the area needed to provide buildings and technological equipment (A_{II}).

The 'cost' of the environmental sustainability of a given service or product is represented by the formula below:

$$SPI\ index = a_{tot}\ /\ a_{in}\ [cap/unit]$$

In the equation, the total footprint of the product/service is represented by a_{tot}, whose value is:

$$a_{tot} = A_{tot}\ /\ N_P\ [m^2.a/unit]$$

The N_P is the number of goods or services supplied by the process in question in a reference period (usually one year).

And a_{in} is the area per inhabitant in a given region. Consequently, the lower the SPI, the lower the ecological impact of the provision of a good or service on the ecosphere.

In summary, this calculation method adds up all the partial footprints calculated from the mass and energy inputs and outputs of all the processes that take place during the life

cycle of the product/service to give the total ecological footprint per unit of the desired product or service. [Narodoslawsky M, Krotscheck C, 1995]

Carmacal is a comprehensive tool, that calculates the carbon footprint of tourism products or destinations, complete packages for tour operators and travel agencies. This tool has a unique level of details, it is combining emissions from land transport and flights, activities and accommodation, developed together with *Travelife for Tour operators*. It is governed by user inputs and a secure user database storing all calculations made by the user for analysis and reuse. Carmacal differentiates the footprint for 25 modes of transport, 21 emission-intensive activities, and gives exact distance calculations. The carbon footprint of flights is specified up to the level of airline and type of plane, for all scheduled flights available. Accommodation carbon footprints are calculated on an individual basis for some 550,000 accommodations worldwide. Accommodations that are not among the 550,000 available, can be specified with a drop-down list of types. For other accommodations, 20 different types with individual emission factors are available. Local transport, individual accommodations, and activities can also be specified on a per-day basis. Locations for transport start and ending points, as well as for accommodation, can also be found via a Google Maps pop-up. The input information is processed using external existing web applications, data from partner resources and proprietary datasets. The processes are fed by information from a range of databases:
Hotel Data: Tavelife for Accommodation
Land Transport: MOBITOOL & University of Breda
Flight data: RDC Aviation & IATA
Activity Data: Travelife for Tour Operators [CARMACAL, 2022]

We tested the two chosen footprint calculators to prove the utilization of the calculators and put them into practise.
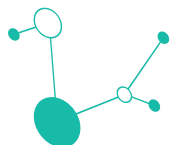
The main focus was on the packages to measure the footprint of them therefore we didn't measure the travel to/from the starting and end point of the package. There were two reasons for that:

- The individual arrival and departure mean that we have no information from/to where our customers come.
- The individual arrival and departure are not part of the package and therefore we didn't want to measure it despite the fact that this would cause the largest footprint.

All of the three packages have the common fact that the arrival and departure was in Osijek – Croatia. We considered it a good starting point as it could be reached by aeroplane car, train etc. Probably most of the clients would arrive by private cars as the average according to our experience two person per one car.
Out of the three package two are 5 days / 4 nights long and the last one is 7 days long and. All of them has border crossing the first one cover three different countries the other two only Croatia and Hungary.
During the program we use a 9-seater minibus plus a bicycle carrier trailer to support the tour. The guests can rent bicycles even e-bike if they don't want or cannot carry their own bikes. They get half-board and a tour guide plus the bus driver provide the service during the tours.

To compare the two footprint calculators, we realized that both has advantages and disadvantage.

Using the 1st one the Ecological footprint calculator it presumes that all of the customers come from Austria and as long as they stay in Europe during their journey it doesn't make too much difference. At the same time, it is capable even to measure the difference of the usage of a normal bike and an e-bike. Regarding the accommodation it doesn't go it deeper it offers different categories from a camping site to a luxury 5 stars hotel, but it doesn't matter too much that this hotel or B&B is in Serbia or in Hungary or anywhere else. It makes difference between vegetarian and non-vegetarian clients. The onsite mobility the next which counts and here we can choose e-bike, normal bike, the supporting car's consumption etc. At the last chapter it offers various onsite activities, but as these kinds of activities are not part of the packages, we didn't deal with it.

Here you can see the result of this calculator how it measured the packages.

English

Ecological Footprint
Calculated with the Sustainable Process Index (SPI ®)

Home   Footprint Calculators   Ecological Footprint for Holidays and Journeys

Home
Ecological Evalution
Foodprint

Footprint Calculators
Personal Ecological Footprint
Footprint Calculator for
Schools
Energy Scouts
Ecological Footprint for
Electricity and Heat
Ecological Footprint for
Holidays and Journeys

Further Tools
RegiOpt
SPIonWeb
ELAS

Imprint
Privacy Policy
Contact

Ecological Footprint for Holidays and Journeys

Start   (Return) Journey   Accommodation and Meals   Mobility (on site)   Activities   **Results**

Results

The result shows the distribution of the environmental pollution as footprint and CO_2 in numbers.
The diagrams show the distribution in percent. At the end you see a comparison of your holiday to the average all-year footprint in Austria.

Footprint and CO_2

(Return) Journey:	0 m²	0,0 kg CO_2
Accommodation:	34.726 m²	143,4 kg CO_2
Meals:	2.062 m²	8,8 kg CO_2
Mobility (on site):	44.519 m²	214,1 kg CO_2
Activities (Without on Site Mobility):	0 m²	0,0 kg CO_2
Total Foot Print (per Person):	81.307 m²	366,3 kg CO_2

Percentage

(Return) Journey:	0,0 %	0,0 %
Accommodation:	42,7 %	39,1 %
Meals:	2,5 %	2,4 %
Mobility (on site):	54,8 %	58,5 %
Activities (Without on Site Mobility):	0,0 %	0,0 %

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Ecological Footprint - Ecological Footprint for Holidays and Journeys
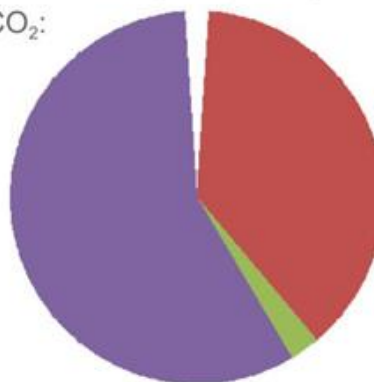
SPI:

CO_2:

Accommodation

Meals

Mobility (on site)

Activities (Without on Site Mobility)

For comparison:

The footprint of your journey is equivalent to **6,2 %** of the average total footprint of an Austrian citizen per year.

<< Previous

The other calculator is Carmacal, which is much more accurate in terms of accommodation, as it has some hotels in its database that are included in our packages - but it is definitely more vague when it comes to local transport, as it focuses more on motorised transport, flights and trains, ferries, buses etc, but doesn't really handle cycling. The only option is the 'non-motorised' category, which could be walking as well.

The packages measured with Carmacal:

ki-2024-01 - 1. 3 countries in the Eastern wilderness

1. 3 countries in the Eastern wilderness

By joining our short adventure cycling tour, you will get a chance to experience the most hidden, untamed, yet beautiful and captivating part of Amazon of Europe Bike Trail – the Eastern part. The Kopaci Rit nature park and the Gornje Podunavlje natural reserve provide for you the real Amazonas feeling mixed with the real hospitality and character of the Balkan. Taste the best fish soups ever!

CO2 footprint of product elements per participant

CO2 emission by type
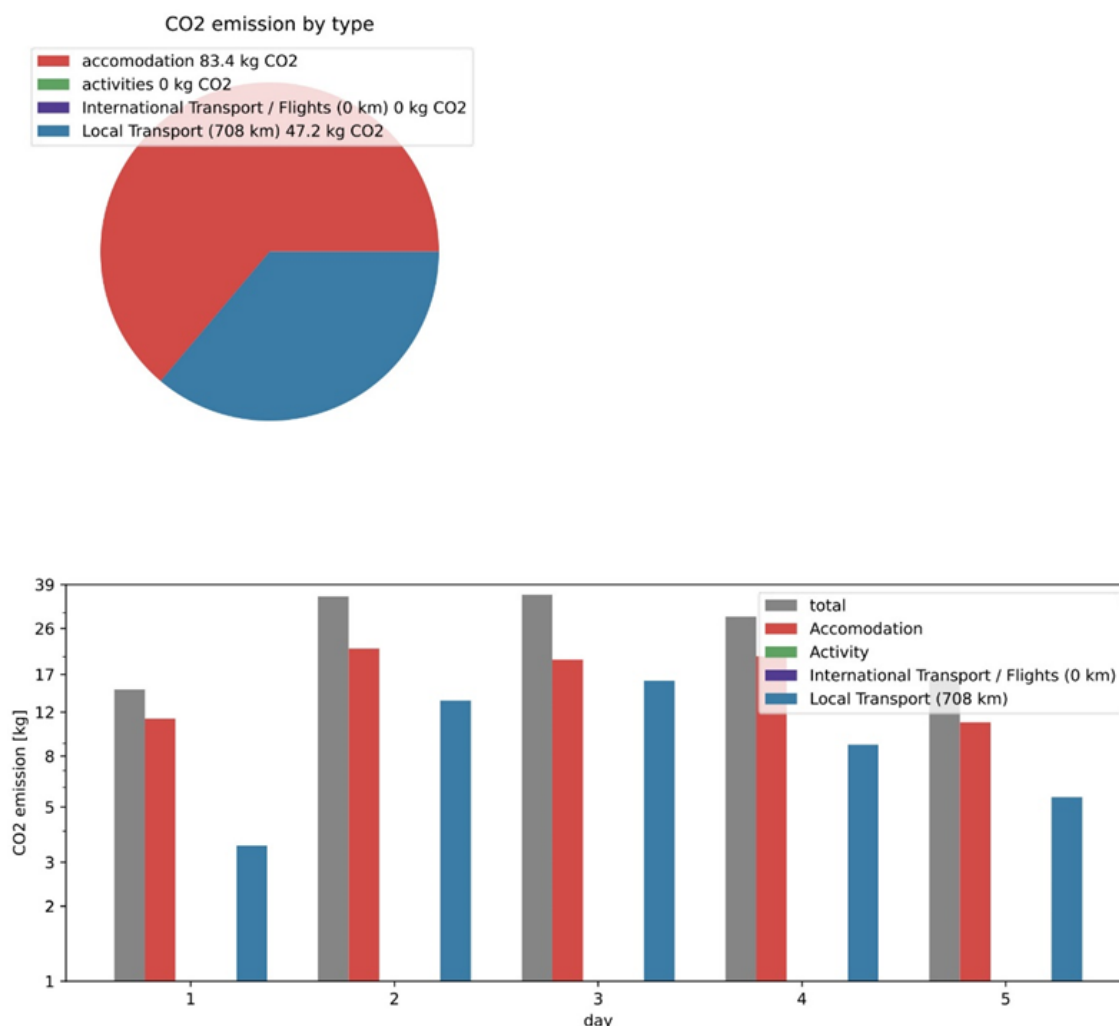
If we compare the two calculators, we clearly see the significant difference.

By the Ecological footprint calculator, the total footprint/person is 366,3 kg at the same time by the Carmacal which use more precise accommodation data and less precise transportation inputs presumably the carbon footprint is only 130,6 kg/ person.

By the Ecological footprint calculator, the share of accommodation and mobility out of the 366,3 kg is 143,4 kg vs. 214,1 kg

By the Carmacal it is 83,4 kg vs. 47,2 kg. The difference is even more significant by the onsite mobility almost triple. We presume that the Carmacal can calculate only 'non-motorized' mobility.

We can compare the carbon footprint of the accommodation with the two calculators:

Accommodation			
	1. package	2. package	3. package
Ecological Footprint	143,4 kg	143,4 kg	215,1 kg
Carmacal	83,4 kg	73,9 kg	121 kg
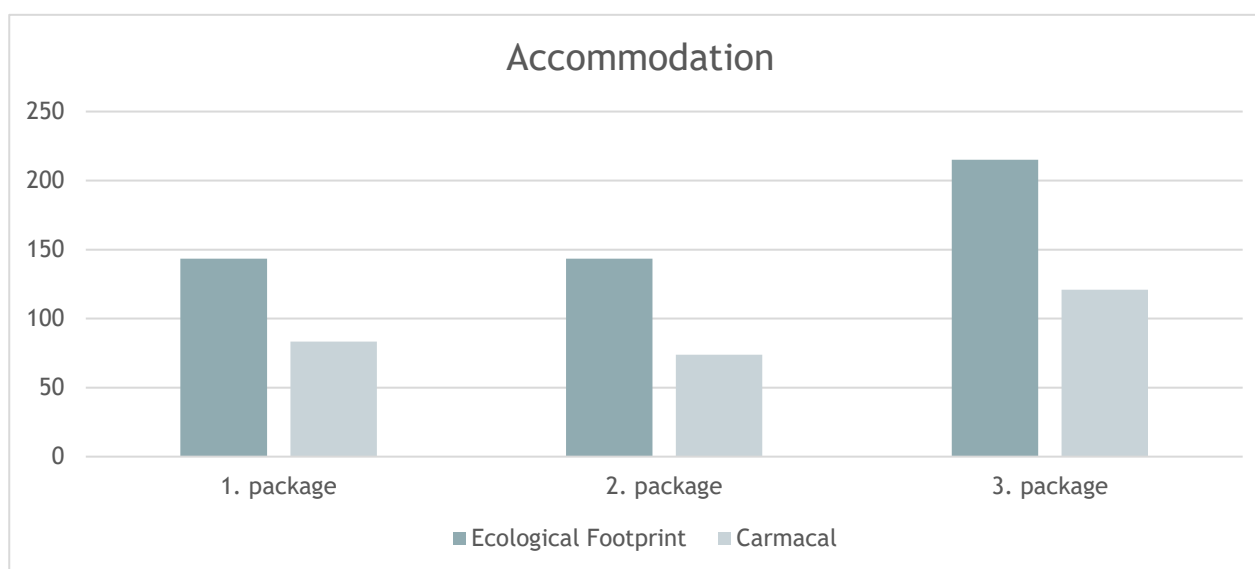
Onsite mobility			
	1. package	2. package	3. package
Ecological Footprint	214,1	187,3	232,2
Carmacal	47,2	15,8	19,6
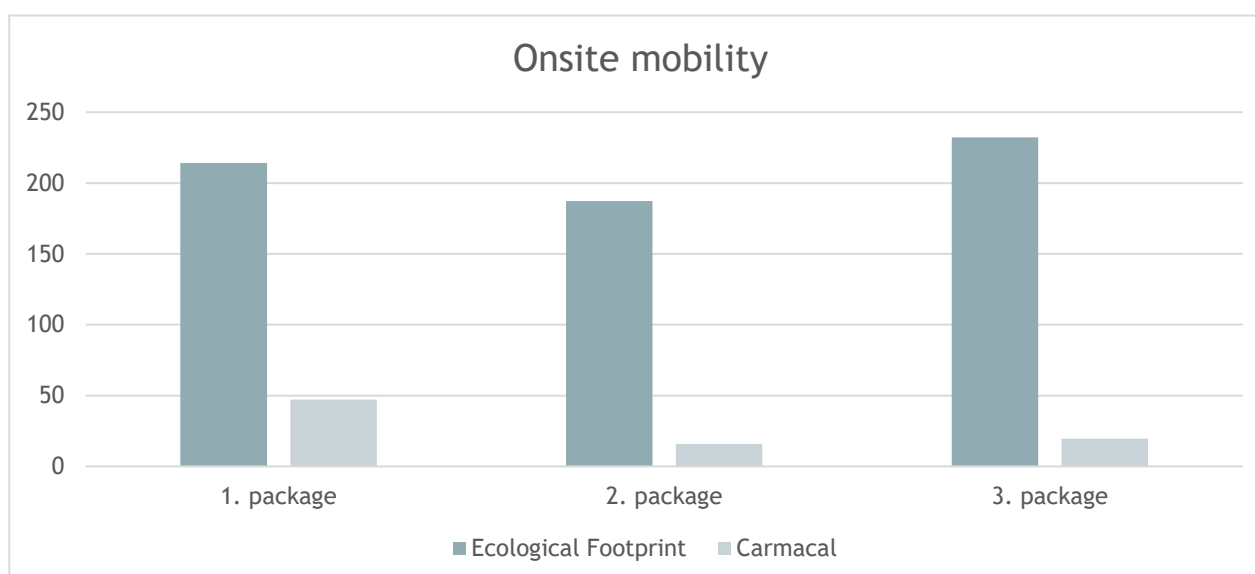
Onsite mobility					
	1. package		2. package		3. package
Ecological Footprint	214,1	708	187,3	685	232,2	890
Carmacal	47,2	708	15,8	685	19,6	890
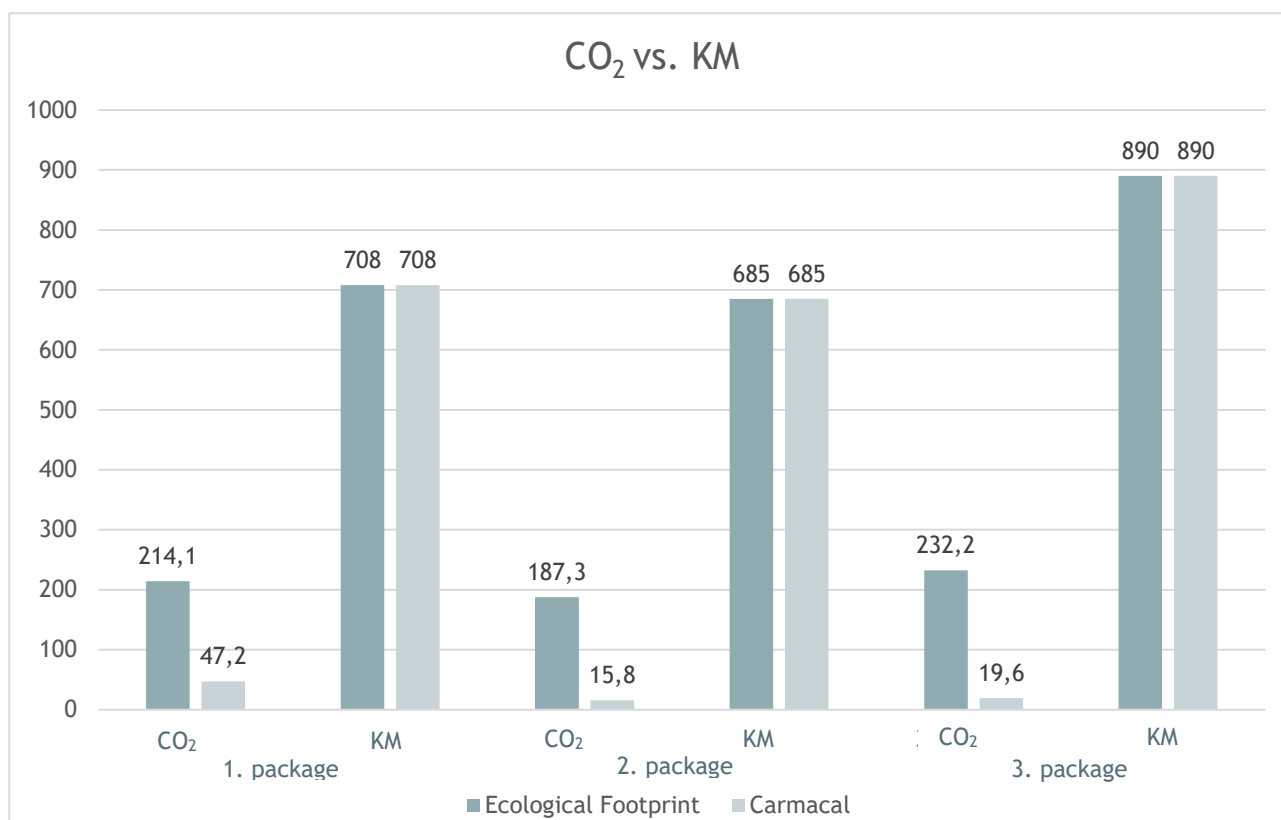
Conclusion

In general the reason of the big difference of the resulting emission data is that, there are three different accounting perspective. This three perspective on air emissions are the follows:

„**The territorial perspective** considers emissions that are released to the atmosphere from within a country's borders and from areas that are under a country's jurisdiction. This perspective is the only method accepted by international environmental law to account for a country's emissions and mitigation efforts. Territorial-emission datasets that focus on the physical location of emissions are also used as the basis for the atmospheric modelling of environmental impacts.

The production perspective considers those emissions from companies that have their economic interest within the economic territory of the country (known as being 'resident') irrespective of the geographic location where their activities take place.It also considers emissions from resident households in relation to their economic output (production), irrespective of the geographic location where these activities take place. The production perspective stems from the

System of Environmental Economic Accounting (SEEA), and a legal basis for reporting of environmental economic accounts has recently been implemented in the EU.

The consumption perspective considers those emissions that result from the national consumption of goods and services within a country, irrespective of the geographic location where production of these goods and services result in emissions. The consumption perspective complements the territorial perspective and the production perspective by rel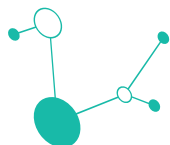ating environmental impacts to demand for goods and services by citizens. The consumption-based perspective is not addressed in international conventions, although consumption emission." [EEA Technical report, 2013]

„In principle these accounting perspectives provide a complementary source of information on air pollutants and greenhouse gases being released into the atmosphere. These three perspectives are all based on different datasets. These datasets use different 'system boundaries' (the type of information that is included) and calculation methods. They also vary in terms of the quality of data they use. These differences in underlying methods and input data affect the resulting emissions calculations." [EEA Technical report, 2013]

„There is a need to develop and agree upon a standardised method for calculating EU travel / holiday rellated emissions. „Given the economic importance of the tourism sector, the estimation of its contribution to CO_2 emissions is important to design sustainable tourism policies." [Kocak et al.,2020]

At the moment there is no standardised regulation of the travel related CO_2 emission calculation methods, therefore now the aim is that the ICTr Partners have to agree in a method / calculator, which they all think is suitable for our project.

Joint assessment of the calculators by the Project Partners

Methodology

The two calculators selected by the CROST team were evaluated by the project partners in 8 different categories (Travel between home and the destination; Accommodation; Mobility within the destination; Applicability to the Iron Curtain Trail; Additional information; Dataset by data accuracy, reliability; Ease of use; Takeaway of information). The evaluation was based on how satisfied they were with a particular feature/parameter of the calculator and how useful/usable they felt the feature was for the ICTr project. The partners indicated their satisfaction with each function as follows:

1 - Very dissatisfied
2 - Dissatisfied
3 - Neutral
4 - Satisfied
5 - Very satisfied

Satisfaction by category was variable. The distribution of responses/satisfaction for each aspect is presented below.

Travel between home and the destination:

Based on the indicator "Travel between home and the destination", Ecological Footprint Calculated with SPI (hereinafter referred to as: Ecological Footprint) proved to be the better choice, with 63.6% of the partners being satisfied with this parameter of the calculator, compared to only 27.3% for CARMACAL. For both calculators, it was noted that manual data entry slows down and complicates the calculation, as a preliminary survey is required to determine accurate distances. In the case of the Ecological Footprint, the "return journey" calculation is inappropriate if the end of the planned journey is not the starting point.

CARMACAL

Based on your experience, please share your satisfaction with the "Travel between home and the destination" category by CARMACAL
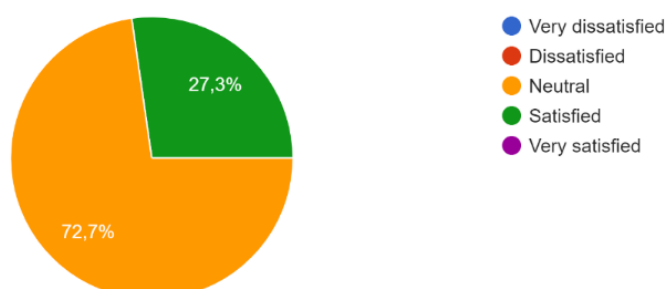
Ecological Footprint:

Based on your experience, please share your satisfaction with the "Travel between home and the destination" category by Ecological Footprint Calculated with the SPI
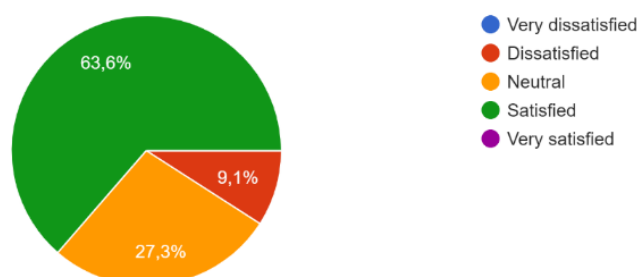
Accommodation:

With regard to the parameters related to accommodation, the Ecological footprint did not prove to be very relevant for the project, as a significant number of partners were particularly dissatisfied with the data available, and there is a problem that the type of accommodation can only be specified for the whole trip, without the possibility to set different types of accommodation per day. In addition, unfortunately sustainable accommodation types are not listed. In contrast, this parameter in CARMACAL allows you to set different accommodation types per day and not only the type of accommodation, but also a very rich database of specific accommodation. The question arises as to whether it is possible to submit and record data on accommodation planned during the ICTr project.

CARMACAL:

Based on your experience, please share your satisfaction with the "Accommodation" category by CARMACAL

Ecological footprint:

Based on your experience, please share your satisfaction with the "Accommodation" category by Ecological Footprint Calculated with the SPI

- ● Very dissatisfied
- ● Dissatisfied
- ● Neutral
- ● Satisfied
- ● Very satisfied
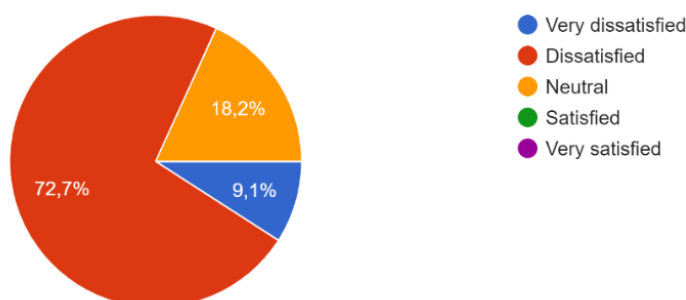
Mobility within the destination:

For the "Mobility within the destination" parameter, the Ecological Footprint was clearly the better choice. The CARMACAL provides details on biking distances but lacks specific cycling option as there is no cycling option, only "non motorised travel". Difficulties in changing the itinerary may affect the overall assessment. This is also reflected in the results, as 36% of partners were dissatisfied with this feature of the calculator. However, Ecological Footprint distinguishes between regular and e-bikes. This is a positive feature, indicating a consideration for eco-friendly modes of transport. As a result, more than 45% of partners were satisfied with the options provided by Ecological Footprint.

CARMACAL

Based on your experience, please share your satisfaction with the "Mobility within the destination" category by CARMACAL

- ● Very dissatisfied
- ● Dissatisfied
- ● Neutral
- ● Satisfied
- ● Very satisfied
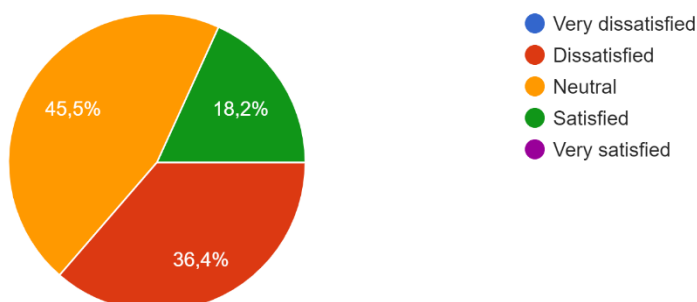
Ecological footprint:

Based on your experience, please share your satisfaction with the "Mobility within the destination" category by Ecological Footprint Calculated with the SPI
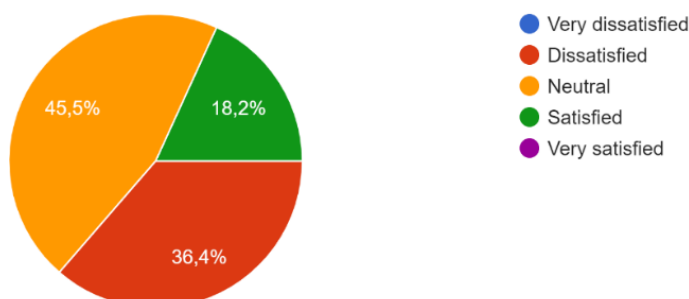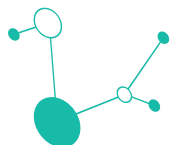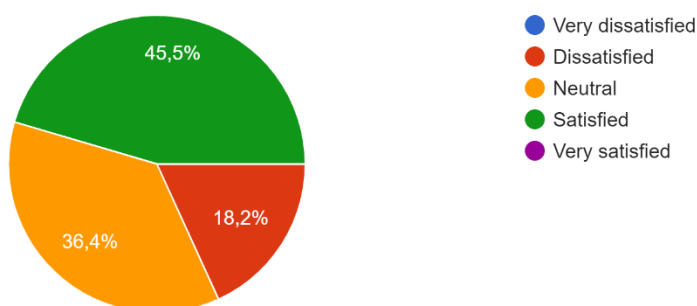

Applicability to the Iron Curtain Trail:

The applicability of the calculators to the Iron Curtain Trail is broadly the same according to the Partners. For CARMACAL, the positive factor is that it can handle multi-day trips and the user can see his/her footprint on a daily basis, but the negative factor is that there is no specific bike category, only "non-motorised", which is not clearly explained. As regards accommodation, if it is possible to integrate the data of the accommodation proposed in the project into the calculator, the accuracy of the calculations could be improved.

The Ecological Footprint is the opposite of CARMACAL in this respect. There is no possibility to handle multi-day trips and no daily breakdown of the footprint generated during the trip. In addition, the accommodation category is unfortunately rather poor, there is no specific accommodation in the database and the optional categories do not always cover the types of accommodation used in the project.

CARMACAL

Based on your experience, please share your satisfaction with the "Applicability to the Iron Curtain Trail" category by CARMACAL
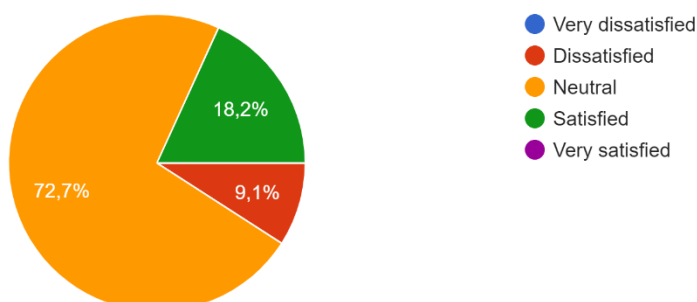
Ecological footprint:

Based on your experience, please share your satisfaction with the "Applicability to the Iron Curtain Trail" category by Ecological Footprint Calculated with the SPI

- ● Very dissatisfied
- ● Dissatisfied
- ● Neutral
- ● Satisfied
- ● Very satisfied
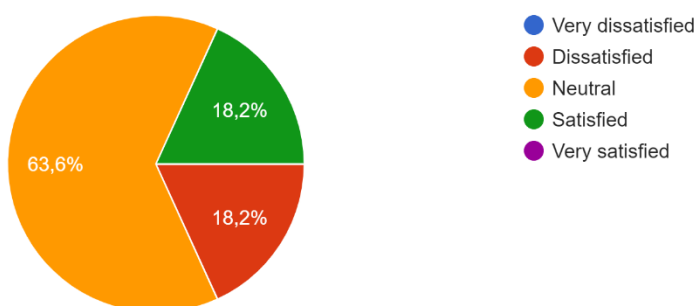
Additional information:

The Ecological Footprint calculator provides detailed data on fuel consumption, cycling distances and types, but the additional activities are irrelevant for the project. The complementary activities used in CARMACAL are also not specifically related to the project and therefore of limited use. This is also evident in the Partners' evaluation, as CARMACAL had minimal satisfaction with this parameter and Ecological Footprint had no satisfaction at all with this feature of the calculator.

CARMACAL

Based on your experience, please share your satisfaction with the "Additional information" category by CARMACAL

- ● Very dissatisfied
- ● Dissatisfied
- ● Neutral
- ● Satisfied
- ● Very satisfied
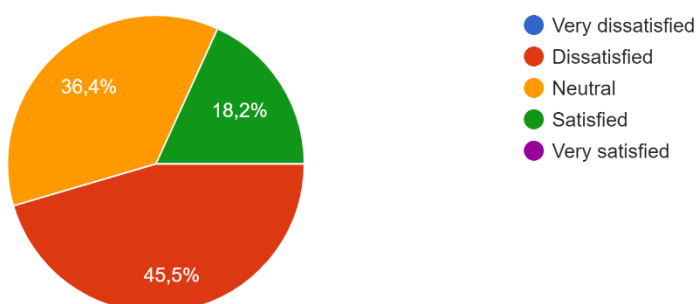
Ecological Footprint:

Based on your experience, please share your satisfaction with the "Additional information" category by Ecological Footprint Calculated with the SPI
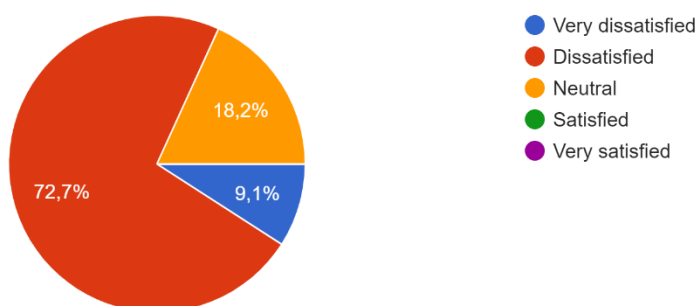

Dataset by data accuracy, reliability:

The accuracy and reliability of the databases used by calculators is difficult to judge. There is currently no specific regulation on the use of footprint calculators. This means that the calculators' creators can decide which databases to use in their calculations (of course, this decision also includes which databases they have access to in the first place). In the case of CARMACAL, a very large database is available, but there is no information on how regularly the available data is extended and updated, nor is the calculation method made available. In the case of Ecological Footprint, even when defining the starting and end points of the journey, only the continental level is available, which suggests that the data used in the calculation does not even reach the national level. If the CARMACAL database can be extended with specific data (locations) included in the project, then of course the use of these data will significantly improve the accuracy and reliability of the calculator.

CARMACAL

Based on your experience, please share your satisfaction with the "Dataset by data accuracy, reliability" category by CARMACAL
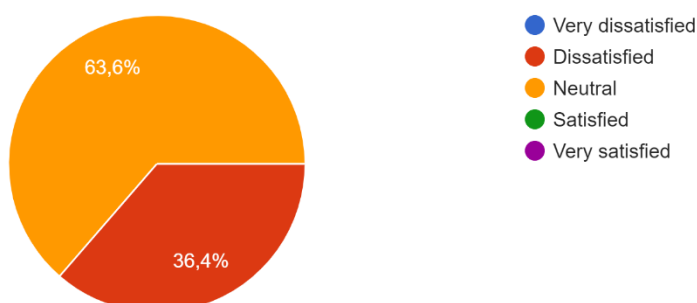
Ecological footprint:

Based on your experience, please share your satisfaction with the "Dataset by data accuracy, reliability" category by Ecological Footprint Calculated with the SPI


- Very dissatisfied
- Dissatisfied
- Neutral
- Satisfied
- Very satisfied
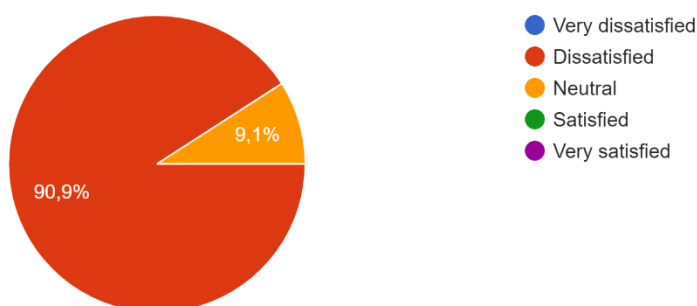
Ease of use:

The "Ease of use" parameter was clearly won by Ecological Footprint. The partners' evaluation showed that most of them were satisfied with the usability of the calculator. Among its positive features, it is well structured, easy to use and the trip report display is adequate, and there is also an option to download it.

In the case of CARMACAL, modifying routes and importing .gpx tracks is a challenge, which affects the overall user experience. No possibility to add day 0. as arrival day.

CARMACAL

Based on your experience, please share your satisfaction with the "Ease of use" category by CARMACAL
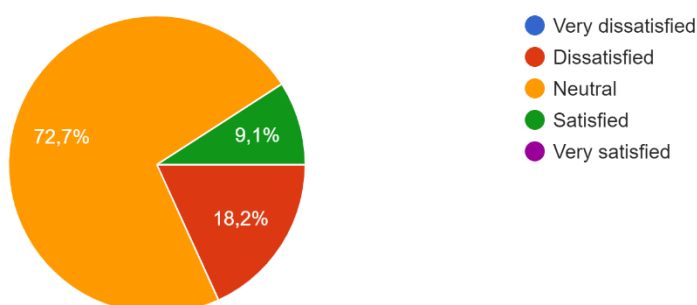
- Very dissatisfied
- Dissatisfied
- Neutral
- Satisfied
- Very satisfied

Ecological footprint:

Based on your experience, please share your satisfaction with the "Ease of use" category by Ecological Footprint Calculated with the SPI
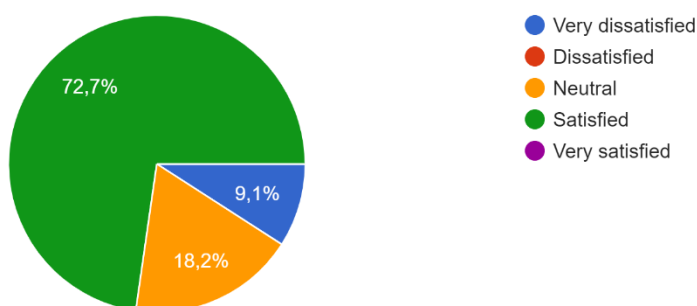
## Takeaway of information:

In contrast to the previous parameter, CARMACAL proved to be better for "Takeaway information". The partners' evaluation clearly shows that they were very satisfied with the CARMACAL report (82% satisfaction rate). The fact that CARMACAL produces daily reports showing the footprint of the trip by category was very positive. In contrast, Ecological Footprint does not provide a daily breakdown of the footprint generated. However, it is positive that it compares the result with an austrian citizen's average yearly footprint

CARMACAL

Based on your experience, please share your satisfaction with the "Takeaway of information" category by CARMACAL

Ecological footprint:

Based on your experience, please share your satisfaction with the "Takeaway of information" category by Ecological Footprint Calculated with the SPI
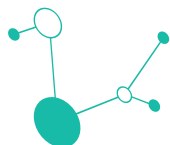

- ● Very dissatisfied
- ● Dissatisfied
- ● Neutral
- ● Satisfied
- ● Very satisfied

81,8%

18,2%
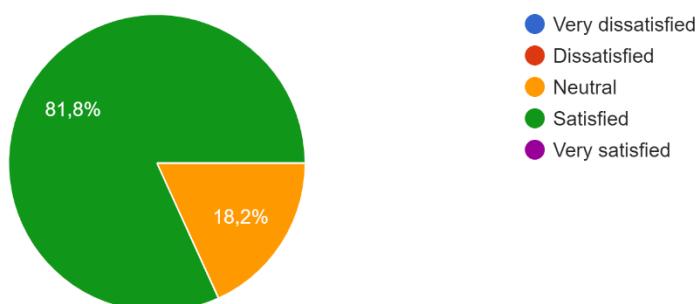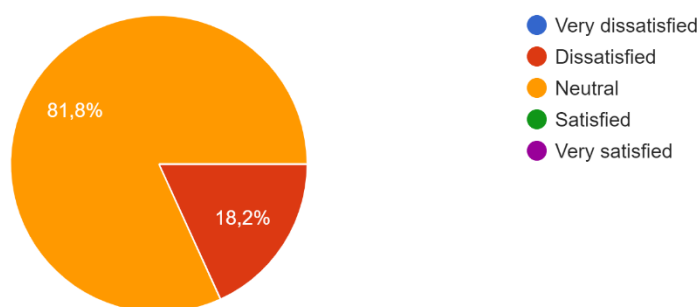
Evaluation

As a result of the joint evaluation by the partners, CARMACAL was found to be appropriate for the project. It scored a total of 265 points, 18 points more than the Ecological Footprint (247 points). CARMACAL scored higher in 5 categories and Ecological Footprint in 3.

36	**39**	Travel between home and the destination
31	23	Accommodation
31	**36**	Mobility within the destination
34	33	Applicability to the Iron Curtain Trail
30	23	Additional information
29	23	Dataset by data accuracy, reliability
32	**39**	Ease of use
42	31	Takeaway of information

We hope that as the calculators rapidly expand and become more important, more and more people will participate in these surveys and provide data on their use. We will also have more efficient tools and hopefully a generally accepted calculation method or framework to measure our CO_2 emissions as accurately as possible.

Integration of CARMACAL with the ICTr product

The existing personalised management and booking system used by Trail Angels will be sustainably and innovatively enhanced by integrating the CARMACAL footprint calculator into the ICTr product.

In the CARMACAL system, we can create a so-called "my product", which in our case is a template of the route(s) defined in the ICTr project (which can be booked in the future). In the "my product", we can pre-set the number of days and the locations/stops of the planned route. The further settings of the "my product" are now up to the user(s) of the service. The type of vehicle to be used, the transport of luggage, extra activities (museums, sightseeing, shopping), the type of accommodation and the dining habits can be set up according to individual needs during the booking negotiation. As a first step of integration, the CROST team created a "my product" in the CARMACAL system, identical to the southern itinerary of the ICTr project's Explorer tour.

Source: https://beta.carmacal.com/
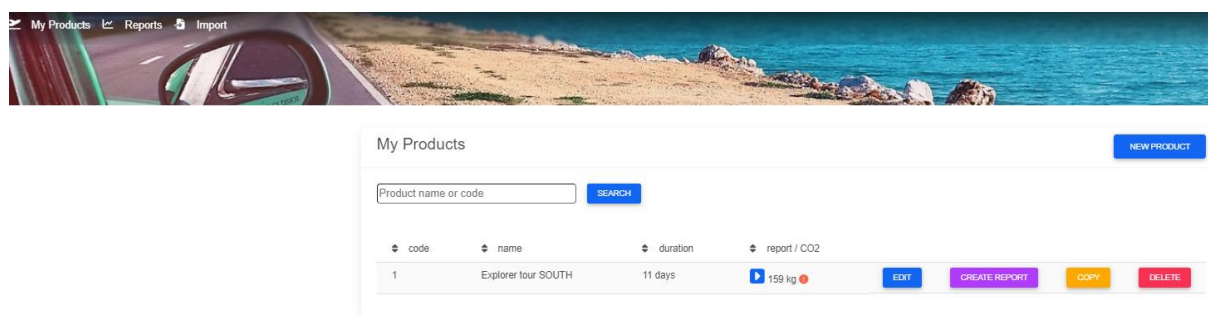
CROST already had the itinerary for the planned Explorer tours, so we had information about the duration of the tours and the villages6towns involved. With this information, a template for any itinerary could be created. However, in order to obtain a more accurate estimate of the CO_2 produced by the itineraries, we can add to the CARMACAL system the accommodation selected or, if the selected accommodation is not included in the CARMACAL system, then its type. The information on the type of accommodation available in each settlement and the data related to it (whether it is possible to cater for different eating habits in the accommodation, whether we know exactly the CO_2 emissions of the accommodation) was not available to the CROST team.

To achieve a higher level of integration, the CROST team asked the partners involved in Explorer tours to compile a table of the hospitality venues on the Explorer tour itineraries. To this end, CROST has created an excel sheet on the ICTr shared drive, which contains all the itineraries related to the Explorer tour. The partners concerned provided CROST with the data on the hospitality venues by filling in the spreadsheet.

The table prepared by the CROST team to collect the data looked like the following picture:

Accomodations_Restaurants_Explorer tour .XLSX

Meals-SOUTH

	Country	Meal	Restaurant	Additional info	Webpage
	HU	restaurant	Garda Hotel	restaurant and breakfast	https://gardahotel.hu/
	HU	restaurant	Vadász Panzió	restaurant and breakfast	https://vadaszpanzio.hu/hu/
	HU	dinner	Hotel Zsida Panzió	breakfast is included	https://zsidatermal.hu/
	SLO	self-paid lunch	Gostilna Pri Lujzi		https://www.prilujzi.si/
	SLO	dinner	Bella Venezia	breakfast is included	https://bellavenezia.si/en/
	HU	self-paid lunch	Kantin Gasztrokocsma		They have no webpage. Menu can be found on their Facebook page: https://www.facebook.com/kantinlovaszi/
	HU	dinner	Radics Panzió Étterem és Pihenő Központ	breakfast is included	https://letenyepanzio.hu/etterem/
		restaurant	M7 étterem	restaurant and breakfast	https://letenyemenu.hu/
0	CRO	self-paid lunch	Restoran & Pansion Fakin	breakfast is included	https://fakin.hr/
1	CRO	dinner	Hotel Zlatan	breakfast is included	https://www.hotel-zlatan.com/
2	CRO	self-paid lunch	Grofova hiža		https://www.facebook.com/p/Izleti%C5%A1te-Grofova-Hi%C5%BEa-100061316716762/
3	CRO	dinner	Hotel Picok	breakfast is included	https://www.hotel-picok.hr/o-hotelu/
4	CRO	lunch included	Boat tour from Brodic to Križnica, lunch provided by Etno house Karlovčan		https://www.facebook.com/EtnoKuceKarlovcanBrodic/?locale=hr_HR
5	HU	dinner	Erdődy Vendégház	breakfast is included	https://www.booking.com/hotel/hu/erdody-vendeghaz.hu.html?aid=319854&label=erdody-vendeghaz-EAuy6WGC28yVN_MkntWKEwS632011413248%3Apl%3Ata%3Ap1%3Ap2%3Aac%3Aap%3Aneg%3Afi%3Atikwd-1638789454758%3Alp1007624%3Ali%3Adec%3Adm%3Appccp%3DUmFuZG9tSVYkc2Rllyh9YfebvPBblhsA9v88nhiHKml&sid=6bdbc474556392f5d2b3e6e149f62a1c&dest_id=-857350;dest_type=city;dist=0;group_adults=2;group_children=0;hapos=1;hpos=1;no_rooms=1;req_adults=2;req_children=0;room1=A%2CA;sb_price_type=total;sr_order=popularity;srepoch=1719233812;srpvid=d59b5b06faae007a;type=total;ucfs=1&
6	HU		Self-paid lunch at Port not at the port, in the village Revfalu		
7	HU	Kémes	Ormánsági Halászcsárda fish carda		https://www.facebook.com/zsuzska1963/?locale=hu_HU
8	HU	breakfast	local Ormansak House		

Accomodations-SOUTH — Meals-SOUTH — Accomodations - CENTRAL — Meals - CENTRAL — Accomodations - NORTH — Meals - NORTH

Accomodations_Restaurants_Explorer tour .XLSX

Accomodations-SOUTH

	Country	Location	Accomodation	Additional info	Webpage	Type of accomodation
1	HU	Szombathely	Garda Hotel	restaurant and breakfast	https://gardahotel.hu/	hotel
2	HU	Szombathely	Vadász Panzió	restaurant and breakfast	https://vadaszpanzio.hu/hu/	guest accommodation
3	HU	Szentgotthárd	Hotel Zsida Panzió	one night with breakfast	https://zsidatermal.hu/	guest accommodation
4	HU	Szentgotthárd	Lipa Hotel	ez egy nagyobb hotel, dinner and breakfast	www.lipahotel.hu	hotel
5	HU	Őriszentpéter	Centrum Étterem és Panzió	breakfast included	https://www.facebook.com/centrum.etterempanzio/	Pension/Bed & Breakfast/Guesthouse/Ecolodge
6	SLO	Lendava	Hotel Lipa		http://lipa-lendava.sloveniahotel.net/hu/	hotel
7	SLO	Lendava	Hotel Cubis	one night with breakfast	https://www.hotelcubis.si/en/	hotel
8	HU	Letenye	Radics Panzió Étterem és Pihenő Központ	breakfast is included	https://letenyepanzio.hu https://www.facebook.com/radicspanzio.etteremwelness/?locale=hu_HU	Pension/Bed & Breakfast/Guesthouse/Ecolodge
9	HU	Letenye	M7 Galéria és Panzió	AoE contracted accommodation, breakfast and restaurant	https://m7galeriapanzio.webnode.hu/	Pension/Bed & Breakfast/Guesthouse/Ecolodge
10	CRO	Koprivnica	Hotel Zlatan	one night with half-board included	https://www.hotel-zlatan.com/	hotel
11	CRO	Koprivnica	Hotel Podravina	one night with half-board included	https://hotel-podravina.hr/	hotel
12	CRO	Koprivnica	Apartmani Marbis	without breakfast / own kitchen	https://www.tripadvisor.in/Hotel_Review-g1026893-d3641167-Reviews-Apartmani_Marbis-Koprivnica_Koprivnica_Krizevci_County_Central_Croatia.html	apartment
13	CRO	Durdevac	Hotel Picok	one night with half-board included	https://www.hotel-picok.hr/o-hotelu/	hotel
14	HU	Kastélyosdombó (Drávatamási)	Erdődy Vendégház	one night with half-board included	https://www.booking.com/hotel/hu/erdody-vendeghaz.hu.html?aid=319854&label=erdody-vendeghaz-EAuy6WGC28yVN_MkntWKEwS632011413248%3Apl%3Ata%3Ap1%3Ap2%3Aac%3Aap%3Aneg%3Afi%3Atikwd-1638789454758%3Alp1007624%3Ali%3Adec%3Adm%3Appccp%3DUmFuZG9tSVYkc2Rllyh9YfebvPBblhsA9v88nhiHKml&sid=6bdbc474556392f5d2b3e6e149f62a1c&dest_id=-857350;dest_type=city;dist=0;group_adults=2;group_children=0;hapos=1;hpos=1;no_rooms=1;req_adu	apartment

Accomodations-SOUTH — Meals-SOUTH — Accomodations - CENTRAL — Meals - CENTRAL — Accomodations - NORTH — Meals - NORTH
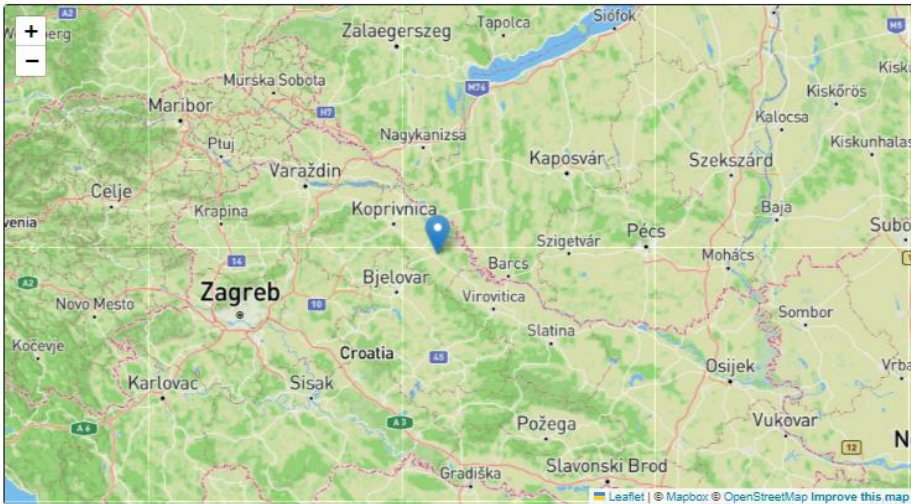
The completion of the table has therefore helped the CROST team to check which accommodation establishments are already included in the CARMACAL list, which will allow to predict how many accommodation establishments are on the route for which, due to lack of information, we can only provide data by type and thus calculate CO_2 emissions. For the accommodation already included in the CARMACAL system, CARMACAL calculated an approximate amount of CO_2 produced by the accommodation based on the type of accommodation, the landscape and the consumption patterns. The completed table showed that a significant number of accommodation units are included in the CARMACAL system. This is beneficial for the project, as a more accurate carbon footprint value is obtained at the end of the project if the value calculated by CARMACAL is used instead of the value calculated by the type of accommodation establishments. However, there are of course some that are not yet included in the CARMACAL system, so we have to refer to the type of accommodation.

In order to get the values as close to reality as possible, the CROST team contacted CARMACAL and found out that it was possible to enter specific data for each accommodation into their system. To do this, CARMACAL needs the accommodations to fill in an excel sheet called HCMI and send it to CARMACAL, thus certifying the authenticity of the data and their consent to have it entered into CARMACAL's system.

"Hotel Carbon Measurement Initiative (HCMI) is a methodology and free tool for hotels to calculate the carbon footprint of hotel stays and meetings in their properties." (World Sustainable Hospitality Alliance, 2022.)

	Key	
	To be manually completed by hotel	
	Select from dropdown	
	Automatically calculated	
	Not applicable	
*	See definitions tab for guidance or refer to comments	

CONTACT & HOTEL DETAILS

1	Name	
2	Job Title	
3	Reporting Year Ending*	
4	Name of Hotel	
5	Name of Hotel Group	
6	Address	
7	City	
8	Country	
9	State/Province	
10	Zip/Postal Code	
11	Total area of guest rooms and corridors	
12	Total area of meeting facility space	
13	Total area of conditioned space*	
14	Unit of Measurement for the above areas*	
15	Total number of guest rooms	
16	Total number of occupied rooms* for reporting year	

In the HCMI table, in addition to the basic data on the accommodation (area, number of rooms, air conditioning use), annual consumption values are required, and there are also questions on laundry and renewable energy. Based on these, the HCMI table calculates the carbon footprint emission values for the accommodation, which are then displayed in its system.

RESULTS

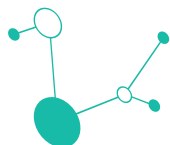| CARBON FOOTPRINT		
Total CO2e for reporting period	–	**tCO2e**
Total Guestrooms Carbon Footprint		tCO2e
Total Meetings Carbon Footprint		tCO2e
Carbon footprint per occupied room on a daily basis		kgCO2e/occ room
Carbon footprint per area of meeting space (1 sqm/sqft) on an hourly basis		Select UoM under Hotel Details
Carbon footprint per sqm/sqft on an annual basis		Select UoM under Hotel Details

The partners involved in the activity were asked to send the HCMI table to the hostels concerned. The HCMI table has also been sent to the accommodation establishments that are already in the CARMACAL system, as returning the table will allow a more accurate data on the specific accommodation establishment to be entered into the system.

The partners have (in several cases) sent the table to the hospitality venues concerned, but unfortunately they have not received a completed table back, which shows that the hospitality venues either do not have the time or are not willing to deal with this topic.

Given that the route template can already be generated with the number of days and locations, and that many of the CO2 emission values for the accommodation (included in the planned routes) are already in CARMACAL, it is possible to calculate the approximate amount of CO2 generated during the route, despite the fact that the hospitality venues did not return the HCMI table.

The picture shows that almost all of the accommodation on the Explorer tour southern route is listed in the CARMACAL system, there was only one accommodation that was not in the CARMACAL system and therefore we could only set the type of accommodation (Pension/Bed & Breakfast/Guesthouse/Ecolodge).
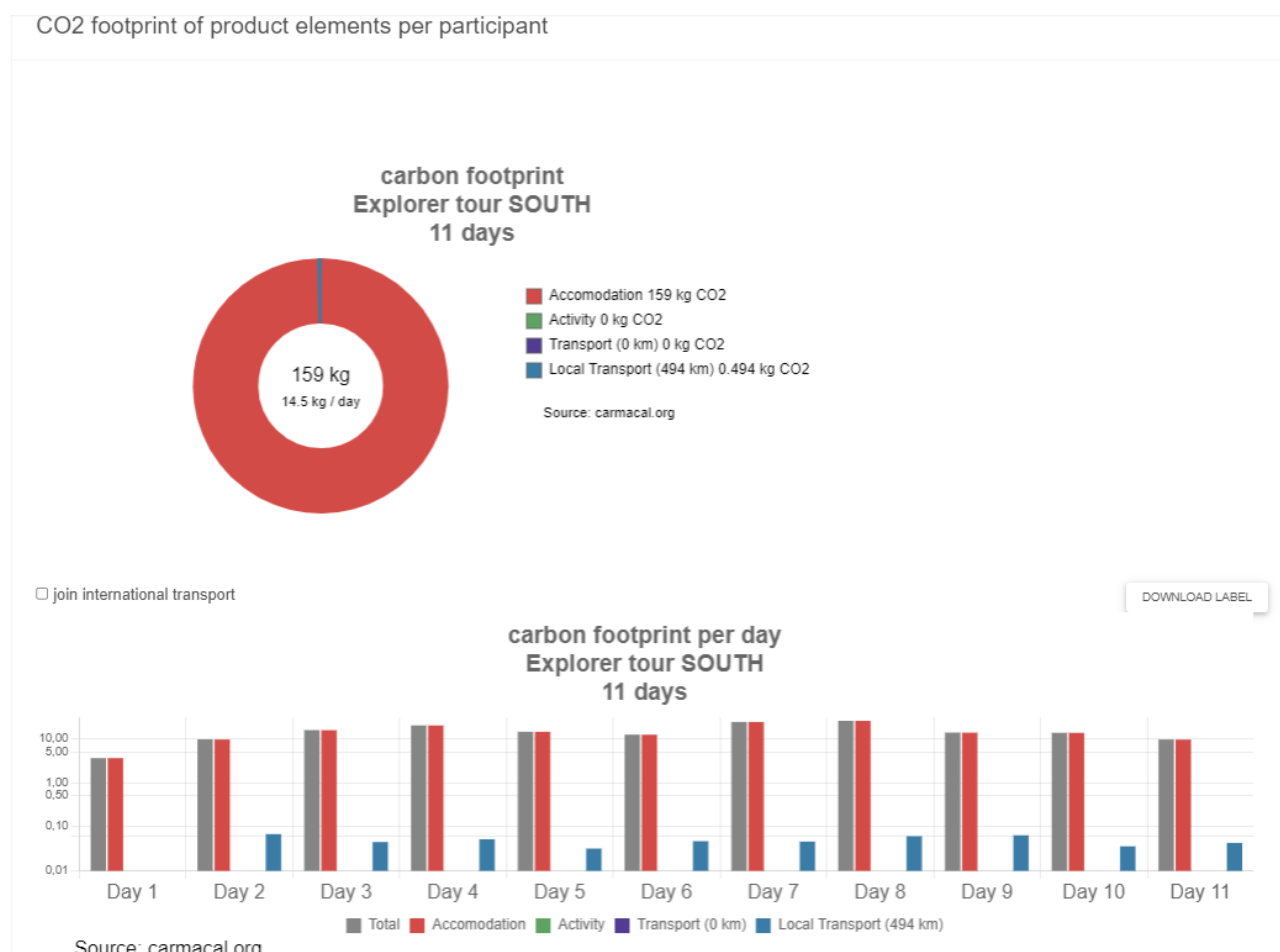
Accommodation can also be recorded in the template if there is only 1 unit that meets the needs of a given location, or if the operator decides to work exclusively with that one accommodation, thus only including this option in the offer for that location.
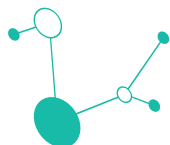
The template has been created with the basic data, no meals or other activities have been added. The current setup does not include the transport of luggage, and the type of vehicle used is not electric but a simple bicycle. These settings can be easily modified to suit individual needs.

Summary

The itineraries to be sold in the existing personalised management and booking system used by Trail Angels can be pre-created as templates in CARMACAL as described above, and the carbon footprint produced during the trip can be obtained by adding the individual requirements when the bookings are received. This can be displayed in a diagrammatic form, broken down and shared with the service user, thanks to CARMACAL's system.

CO2 footprint of product elements per participant

carbon footprint
Explorer tour SOUTH
11 days

159 kg
14.5 kg / day

- Accomodation 159 kg CO2
- Activity 0 kg CO2
- Transport (0 km) 0 kg CO2
- Local Transport (494 km) 0.494 kg CO2

Source: carmacal.org

☐ join international transport

DOWNLOAD LABEL

carbon footprint per day
Explorer tour SOUTH
11 days

Day 1 | Day 2 | Day 3 | Day 4 | Day 5 | Day 6 | Day 7 | Day 8 | Day 9 | Day 10 | Day 11

Total   Accomodation   Activity   Transport (0 km)   Local Transport (494 km)

Source: carmacal.org

The creation of templates is the basis of the integration, which can be further extended based on the reservations received. In order to get a more accurate estimate of the carbon footprint of the hospitality venues on the routes, we have tried to contact them, but it seems that these venues are not interested in providing this data. Our aim is to explore further possibilities to convince hospitality venues that it is worthwhile to provide data on the CO2 produced and thus be included

in the CARMACAL system, as there are some guests for whom this is a priority. This gives an advantage to venues that care about their environment and inform their guests about this, compared to those that do not.

Name of the footprint calculator	Evaluation categories	Westpannon	Iskriva	University of Primorska	Trail Angels GmbH	Public benefit company Partnerstvi	Westpomeranian Region	City of Gdańsk	Ekopolis Foundation	European Cyclists' Federation	Koprivnica Križevci County	Ecological Tourism in Europe	
CARMACAL https://login.carmacal.org/	Travel between home and the destination	3	4	3	3	3	3	3	4	4	3	3	36
	Accommodation	3	3	4	2	2	3	2	3	4	2	3	31
	Mobility within the destination	2	3	3	2	3	2	4	2	4	3	3	31
	Applicability to the Iron Curtain Trail	3	3	3	3	2	3	3	4	4	3	3	34
	Additional information	3	4	4	2	3	2	3	3	2	2	2	30
	Dataset by data accuracy, reliability	2	2	3	2	3	3	2	3	3	3	3	29
	Ease of use	3	2	2	3	4	3	3	3	3	3	3	32
	Takeaway of information	4	3	3	4	4	4	4	4	4	4	4	42
													265
Ecological Footprint Calculated with the Sustainable Process Index https://www.fussabdrucksrechner.at/en/calculation/tourism/1	Travel between home and the destination	3	4	3	3	2	4	4	4	4	4	4	39
	Accommodation	2	3	2	2	3	2	2	1	2	2	2	23
	Mobility within the destination	4	4	2	3	2	3	4	3	4	4	3	36
	Applicability to the Iron Curtain Trail	2	3	3	3	4	3	3	2	4	3	3	33
	Additional information	1	2	3	2	3	2	2	2	2	2	2	23
	Dataset by data accuracy, reliability	2	2	2	2	2	2	2	2	3	2	2	23
	Ease of use	4	4	4	4	1	4	4	4	4	3	3	39
	Takeaway of information	2	3	3	3	3	3	3	2	3	3	3	31
													247

Gössling, S.; Hansson, C.B.; Hörstmeier, O.; Saggel, S. Ecological footprint analysis as a tool to assess tourism sustainability. *Ecol. Econ.* **2002**, *43*, 199–211.

https://www.sciencedirect.com/science/article/abs/pii/S0921800902002112?via%3Dihub

Patterson, T.M.; Niccolucci, V.; Bastianoni, S. Beyond "more is better": Ecological footprint accounting for tourism and consumption in Val di Merse, Italy. *Ecol. Econ.* **2007**, *62*, 747–756.

https://www.sciencedirect.com/science/article/abs/pii/S0921800906004691?via%3Dihub

Peeters, P.; Schouten, F. Reducing the ecological footprint of inbound tourism and transport to Amsterdam. *J. Sustain. Tour.* **2006**, *14*, 157–171.
https://www.tandfonline.com/doi/abs/10.1080/09669580508669050

Krotscheck, C., M. Narodoslawsky: The Sustainable Process Index - A new Dimension in Ecological Evaluation. Ecological Engineering 6/4, 1996

Narodoslawsky M, Krotscheck C.: The sustainable process index (SPI): evaluating processes according to environmental compatibility. Journal of Hazardous Materials, 1995

CARMACAL - Carbon management calculator for tour operators, **2022**
https://www.ectaa.org/Uploads/documents/CARMACAL-flyer.pdf

European Union CO_2 emissions: different accounting perspective, EEA Technical report No 20/2013

https://www.eea.europa.eu/publications/european-union-co2-emissions-accounting

Emrah Koçak, Recep Ulucak, Zübeyde Şentürk Ulucak: The impact of tourism developments on CO_2 emissions: An advanced panel data estimation, Tourism Management Perspectives, Volume 33, January 2020
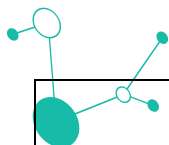
https://www.sciencedirect.com/science/article/abs/pii/S2211973619301436

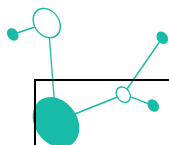World Sustainable Hospitality Alliance

https://sustainablehospitalityalliance.org/resource/hotel-carbon-measurement-initiative/

Annexes

Calculators collected by the ICTr project partners

ICTr-CE

Name of Footprint calculator	Footprint of travel between home and the destination 1) plane; 2) car; 3) train; 4)boat; 5) combination	Footprint of the accommodation and related services (equipment and meals)	Footprint of mobility within the destination and the related services (transfer of bicycles, luggage, return transfer of tourists to the destination)	The footprint calculator has offsetting options (yes/no)	Mobile app and/or online tool	Specific environmental aspects (such as water, waste, energy, etc.)	Comments	Website	Is the footprint calculator applicable to the Iron Curtain Trail? Yes/No	Is this a cycling related footprint calculator? Yes/No
Greentipper	combination: Plane Car Boat (ferry, cruise) Train Tram Metro Bus Motorbike Electric bike	Type of accommodation	Plane Car Boat (ferry, cruise) Train Tram Metro Bus Motorbike Electric bike	yes	online tool	if the accomodation is not a hotel, additional information can be added, like gas, coal, fuel and electricity usage of the house	Only one mode of transport / accommodation can be measured in a calculation. For a multi-day trip, each part must be measured separately and then added together at the end. The calculator is run by a Belgian organisation, but there is no information on the database used.	https://greentripper.org/default.aspx?cl=en?&olt=moto	yes (e-bike only)	No
MOJECO2	combination: Plane Car Public transport Motorbike Electric bike Non-motorised	Type of accommodation	Plane Car Public transport Motorbike Electric bike Non-motorised	yes	online tool	sport, pet, shopping and accomodation aspects can be added	Accommodation, travel and other consumption (food/drink/shopping) must be calculated separately, but several types of accommodation or travel can be indicated within one calculation.nIf you choose the e-bike, you need to know how much is the estimated consumption of the e-bike + the distance in km	https://www.offsetujemeco2.cz/	yes	Yes

							ICTr-CE			
Carbon Footprint Calculator For Individuals And Households	combination: Plane Car Motorbike	Household footprint - consumption of each type of energy can be added (min. time period is 1 week)	Car Motorbike Bus Train Metro Taxi	yes	online tool	energy	additional spend options: •Food and drink products •Pharmaceuticals •Clothes, textiles and shoes •Paper based products (e.g. books, magazines, newspapers) •Computers and IT equipment •Television, radio and phone (equipment) •Motor vehicles (not including fuel costs) •Furniture and other manufactured goods •Hotels, restaurants, and pubs etc. •Telephone, mobile/cell phone call costs •Banking and finance (mortgage and loan interest payments) •Insurance •Education •Recreational, cultural and sporting activities For accommodation, need to specify the annual energy consumption of the property no bike or e-bike, only motorbike is available + the distance in km For extra services the minimum consumption period is 1 week.	https://www.carbonfootprint.com/calculator.aspx	yes	No

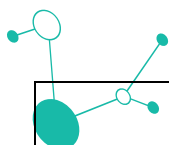|								
EuroVelo Route Planner	compares different type of transport with cycling	not included	not included	no	online tool	No additional information	ECF developed a EuroVelo Route Planner in the frame of the AtlanticOnBike project, co-funded by the EU Atlantic Area program. This tool helps to plan cycling itineraries along EuroVelo routes across Europe, aiming to provide inspiration without being a navigation tool. It includes a carbon footprint calculator demonstrating the amount of carbon saved by making this itinerary on a bike rather than with a car. This is an additional incentive for users to choose cycling holidays. European cycle route network - only bike/e-bike...no other category is available, like accommodation, meal, transportation) It uses the same calculator as the cyclesheme.co.uk	https://en.eurovelo.com/route-planner	yes	yes
Pomorze Zachodnie (The West Pomerania) mobile app	compares different type of transport with cycling	not included	not included	no	Mobile app and/or online tool	no	CO2 calculatr as a part of the mobile app for cycling tourist. The mobile app is perfect tool for everyone planning a cycling trip in the region and looking for a convenient and reliable guide. The app provides the current routes of West Pomeranian cycling trails, including Euro Velo 13. The app has a simple CO2 calculator that shows how much emissions is saved due to traveling by bike instead of car. The calculator is available only through the app... Only bike/e-bike...no other category is available, like accommodation, meal, transportation), only for Pomeranian trails	https://rowery.wzp.pl/en	yes	yes

Global footprint network - Ecological footprint	combination: Car Motorcycle Plane	general household and consumption data	public transportation	no	online tool	waste, energy, fuel, renewable sources	The Ecological Footprint is the metric that compares the resource demand of individuals, governments, and businesses against Earth's capacity for biological regeneration. Not tourism related.	https://www.footprintcalculator.org/home/en	no	no
Cycle Seeing Atractour	combination: Car Taxi Electric bicycle Bus	not included	not included	no	online tool	energy, waste, water	Measure of environmental habits of tourists during visiting of destination Not tourism related.	https://www.strigova.info/csa/kalkulator-zelenog-otiska/?lang=en	no	no
WWF - How big is your environmental footprint?	combination: Car Motorbike Public transport Train Bus Plane	general household and consumption data	not included	no	online tool	waste, energy, fuel, shopping	General household calculator	https://footprint.wwf.org.uk/questionnaire	no	no
Kalkulačka uhlíkovej stopy	combination: Car Public transportation Train Plane	general household and consumption data	not included	no	online tool	mix of various aspects: energy, waste	The calculator is not related specfically to tourism but to everday. It has two levels - general and more detail. It is the product of the Slovak Environmental Ministry. General household calculator	https://iep.sk/kalkulacka	no	no
Carbon Tracer	combination: Train Car Bus Plane	not included	not included	no	online tool	energy	The calculator is only related to traffic -public transport vs. private, no other information can be added	https://carbontracer.uni-graz.at/app-emissionsvergleich	no	no
Carmacal	combination: Plane Car Boat Train Bus Motor Cycle Scooter Non-Motorized	in some cases exact accomodation data or type of accomodation	combination: Plane Car Boat Train Bus Motor Cycle Scooter Non-Motorized	no	online tool	21 specific activities	The calculator covers the whole holiday and travel packages	https://login.carmacal.org/	no	no

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TUCO2	combination: Plane Boat Coach Car Train	Type of accommodation	Plane Boat Coach Car Train	yes	mobile app	no	No bike or e-bike, no additional info can be added except accomodation	Carbon Neutral Travel App - tuCO2	no	no
Cyclescheme	compares different type of transport with cycling	no information	not included	no	online tool	no	The calculator counts how much energy can be saved if you choose cycling instead of a vehicle only bike/e-bike...no other category is available, like accommodation, meal, transportation), need to know the distance	https://www.cyclescheme.co.uk/health-calculator	commute counting (you can count the CO2 emissions saved per year)	yes
Ecotrip	combination: Plane Public transport Car Bicycle Walking	not included	not included	no	mobile app	No additional information	Ecotrip a sustainable travel app that helps users find eco-friendly accommodations, restaurants, and activities. The app also allows users to calculate their carbon footprint and offset their emissions. The free version offers only different car types to calculate Only car options are available for free	https://www.ecotrip.app/	yes	no
RADsite	combination: Plane Car Taxi Bus Rail Ferry	he country of the accomodation can be selected	can be added	no	online tool	no	Only motorbike can be added, accomodation options by country, no dietary info can be added	https://www.radsite.co.uk/CustomCarbonCalculator/Complete	no	no
Ecological Footprint Calculated with the Sustainable Process Index	combination: Bicycle E-bike Scooter Motorcycle Car Caravan Bus Train Tramway Metro Plane Ship	Type of accomodation	can be added	no	online tool	no	Only return holiday km needed, otherwise just Austria or continental data is available, no exact start and end point can be added, meal as vegetarian/non vegetarian	https://www.fussabdrucksrechner.at/en/calculation/tourism/1	yes	yes