The Environmental Fingerprint. A Case Study

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Abstract. The new concept of "ecological fingerprint" is approached in this paper, together with a case study concerning the "carbon fingerprint". The scientific bases of this concept were elaborated by Rees and Wackernagel, at University of Columbia in early ‘90s. Their overall significance last in the ability of our planet to produce all resources needed for a healthy food, goods, and services supplies, in order to satisfy the consumption needs of population, and also to absorb the waste produced by the earth population and their activities. Thus, the concerned resources, consumptions, waste, etc. are transformed into a single variable. The basis of this approach is represented by the ratio between the human consumption of natural resources and the global capacity of earth to regenerate natural resources. The "global hectares" represents the measure unit for the ecological fingerprint, and it has four components. These four components of the ecological fingerprint are represented by: the carbon fingerprint, the food fingerprint, the housing fingerprint, and the goods and services fingerprint.

Keywords: carbon, housing, goods and services, food, global hectares

INTRODUCTION

Because in last century a continuous decreasing of natural resources supplies was recorded, increasing attention has been given to both planet resources and impacts of anthropic factor on their deployment, and also on finding a method able to allow us to quantify the remaining Earth resources, the rhythm of consumption and ecosystems health status (Bastianoni et al., 2004; Kalacska, et al., 2007).

In last two decades, a new ecological concept was launched – the ecological fingerprint. The scientific bases of this concept were elaborated by Rees and Wackernagel, at University of Columbia in early ‘90s (Rees, 1992; Wackernagel et al., 1995).

An interesting and valuable trait of the ecological fingerprint is represented by the capacity of this sintagm to comprehend an entire methodology, which allows the capacity to combine data from all ecological interesting fields and express them as an equation with four variables. Their overall significance last in the ability of our planet to produce all resources needed for a healthy food, goods, and services supplies, in order to satisfy the consumption needs of population, and also to absorb the waste produced by the earth population and their activities (Wackernagel et al., 1995). Thus, the concerned resources, consumptions, waste, etc. are transformed into a single variable.

The basis of this approach is represented by the ratio between the human consumption of natural resources and the global capacity of earth to regenerate natural resources. The "global hectares” represents the measure unit for the ecological fingerprint, and it has four components (Fig. 1).
The components of the ecological fingerprint include the followings: carbon fingerprint, food fingerprint, housing fingerprint, goods and services fingerprint, and they all contribute by specific ways and means to creation of the global ecological fingerprint (Kalacska et al., 2007; http://khidr.org/Green_Fingerprint.pdf).

The carbon fingerprint represents the land and water areas, necessary to absorb the associate emissions:

- energy consumption;
- transport facilities.

The food fingerprint is the quantity of vegetal and animal food, needed for:

- annual consumption by person;
- area needed in order to absorb the carbon dioxide associated to food production, processing and transport.
The **housing fingerprint** includes the following components:
- land area needed for construction, arrangement and furniture supplies for one house;
- land area needed for one house water supply;
- land and ocean area needed for the absorption of carbon dioxide produced by one house.

The **goods and services fingerprint** is represented by the land and ocean area necessary for:
- absorption of the carbon dioxide emissions associated to goods production, transport and storage;
- commercial activities.

A series of factors have considerable contribution in creating the global ecological fingerprint, from simple components as agricultural land, up to complex factors as those involved in industrial areas (industrial constructions, mining and hydrocarbons industry) up to infrastructure, or reforestation issues (Fig. 2).

![Diagram of carbon fingerprint]

**Fig.2. Example of carbon fingerprint calculation**

**THE CALCULATION OF CARBON FINGERPRINT - A CASE STUDY**

**MATERIALS AND METHODS**

The public illuminate in a medium size town is supplied by 1.50 millions bulbs, with total power of 130 kW.

The main objectives of our study consist of calculation of the quantity of carbon dioxide emissions as consequence of using these sources of energy during one year with an average daily functioning of 8 hours, and how many global hectares of wood trees are needed to assimilate that quantity of carbon dioxide released in atmosphere, by the mentioned source.
These objectives can be achieved by following means: calculation of the total functioning time of the public illuminate, calculation of the total energy consumption expressed in kWh, transformation of the energy consumption in kJ, calculation of the correspondent carbon quantity, and calculation of the corresponding carbon dioxide quantity, calculation of the global hectares needed for absorption of released carbon dioxide.

RESULTS AND DISCUSSIONS

The calculation of the total functioning time of the public illuminate:
3556 days x 8 hours/day = 2.848 hours
The calculation of the total energy consumption expressed in kWh:
2.848 hours x 130 kW = 370,240 kW
370,240 kW x 3.60 = 1,332,864 kWh
1,332,864 kWh x 3.60 = 4,798,310.40 MJ = 4,798.31 GJ

The transformation of the energy consumption in J and gasoline:
4,798.31 GJ/ 43.97 GJ/tone gasoline = 109.13 tones gasoline
109.13 tones gasoline x 1,356 L/tone = 147,980.28 L gasoline

The calculation of the correspondent carbon quantity:
147,980.28 L gasoline x 2.42 : 3.79 = 94,488.72 kg carbon

The calculation of the corresponding carbon dioxide quantity:
94,488.72 kg carbon x 3.66 = 345,828.74 kg CO$_2$

345.83 tones CO$_2$

The calculation of the global hectares needed for absorption of released carbon dioxide:
Taking into consideration that 1 hectare of wood is able to assimilate 5.20 tons of CO$_2$:
345.83 tones CO$_2$/5.20 = 66,505.53 ha of wood
and
1 hectare of wood corresponds to 1.40 global hectares, results

47,503.95 global hectares

CONCLUSION

The quantity of carbon dioxide emissions as consequence of using these sources of energy during one year with an average daily functioning of 8 hours is equal to 345.83 tones CO$_2$, and the number of global hectares is 47,503.95 global hectares).

REFERENCES