PROCEEDINGS

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Edited by Simona Scalbi, Arianna Dominici Loprieno, Paola Sposato

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Carbon Footprint of tropical Amazon fruit jam from agroforestry

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1. Abstract

A cradle-to-grave Carbon Footprint of a jam made with tropical Amazon fruit is presented. The analysis is grouped into three general processes: upstream, core and downstream. In this preliminary study the global warming indicator is considered. Most of the data was gathered on the field by members of ArBio and can be classified as primary data. The cultivation and the jam manufacturing are done in Madre de Dios (Perù) and the product is imported to Italy by Equo Mercato in its final packaging. The present analysis is limited to the Italian market excluding Sicily and Sardinia.

2. Introduction

The Amazon rainforest is one of the most endangered ecosystems on Earth; especially during the last decades, deforestation due to intensive practices such as cattle ranching and monoculture cultivations, has become evident along the Brazilian layout of the Inter-Oceanic highway. After the finalization of the Peruvian part of the highway, areas of the Amazon forest crossed by this infrastructure might undergo damages similar to those that have taken place on the Brazilian side.

Agroforestry [1], a relatively new word that refers to growing trees together with agricultural crops and animals, is a possible solution for restoring degraded and eroded landscapes. Even though the concept is new, humans have practiced agroforestry for thousands of years, providing food, medicine, and materials to their communities in a sustainable way. Furthermore, agroforestry also provides highly valuable ecosystem services, such as conservation of soil and water and biodiversity, in addition to other human benefits such as landscape beauty and wellness. Agroforestry should be considered as an intermediate step towards analog forestry [2], a complex and holistic form of agroforestry aiming at maintaining a functioning tree-dominated ecosystem while providing marketable products that can sustain rural communities, both socially and economically.

ArBio [3], an association born in 2010 in Puerto Maldonado (the capital city of Madre de Dios, the southern Amazon region of Peru), works on a 916 hectares (equivalent to 9,16 km^2 or 2290 acres) area of Amazon forest, obtained through a concession contract granted by the Peruvian government, in association with a neighbouring land owner who also received a land grant of 7.24 km^2 (or 1810 acres). Both areas are involved in a pilot project, which aims at demonstrating that coexistence is possible between the forest ecosystem, local populations and the Inter-Oceanic highway. This idea reflects exactly the meaning of ArBio: Association for the Resilience of the Forest to the Inter-Oceanic (*Asociación para la Resiliencia del Bosque frente a la Inter-Oceánica*). Through agroforestry, and subsequently analog forestry, ArBio works for the sustainable development of this region, trying to avoid that the Inter-Oceanic highway entails the destruction of the forest and the loss of biodiveristy.

Among the marketable products already commercialised by ArBio, there is a jam obtained by the Cupuaçu fruit (*Theobroma grandiflorum*) [4], a tropical rainforest tree from the same family as cacao. Cupuaçu is quite common throughout the Amazon basin and widely cultivated in the jungles of Colombia, Bolivia and Peru and in the north of Brazil. The jam is obtained by the white pulp of Cupuaçu, which has a unique fragrance (a mix of chocolate and pineapple), and for this reason has the potential to become well recognized among tropical fruit-trees. Moreover, expansion of its cultivation to the Amazon does not present any serious limitations, because the climate is suitable and land is available. Also, this species can grow under the shade of the forest canopy.

In the present work, a Carbon Footprint Analysis (CFA) study is performed of the Cupuaçu jam supply chain, from the agroforestry practice realized by ArBio and its local partners in the Madre de Dios (Peru), to the commercialization in Italy by ArBio Italia through Equo Mercato [5] in Cantù (Northern Italy).

3. System Description

General boundaries of the system are sketched in Figure 1. The perspective adopted is from-cradle-to-gate and the division of phases into three macro-processes, i.e. upstream, core and downstream, was done following the Product Category Rule published by Environdec [6]. The upstream processes comprise the fruit cultivation, transportation from field to plant, ingredients production, and secondary and tertiary packaging production. Operators carry out in-field operations without using any machine. Primary packaging production, i.e. glass pot and caps, have been included in the core process together with product manufacturing, thermal treatment and packaging processes. Cultivation and jam manufacturing are located in the Madre de Dios region in Peru. The downstream processes are essentially transportation to Italy (Puerto Maldonado – Callao Harbour - Genova harbour – ArBio warehouse in Cantù) and delivery to sale points distributed over the Italian peninsula. For the present case, Sicilia and Sardinia sale points were not considered. End-of-life scenarios were created in accordance with recycling to landfill ratios published in the Ispra report [7] as for glass pots and metal caps.

The functional unit adopted is 1 kg of product including packaging, but packaging weight is not included in the 1 kg. The cupuaçu jam is sold in pots containing 212 g of product, as detailed in Table 1. Cupuaçu jam has no additives or preservatives; the only ingredients are fruit pulp and sugar cane. The average pulp-to-fruit ratio is 0.25 and the cultivation yield is about 2000 kg of fruit per hectare per year (see Table 2).

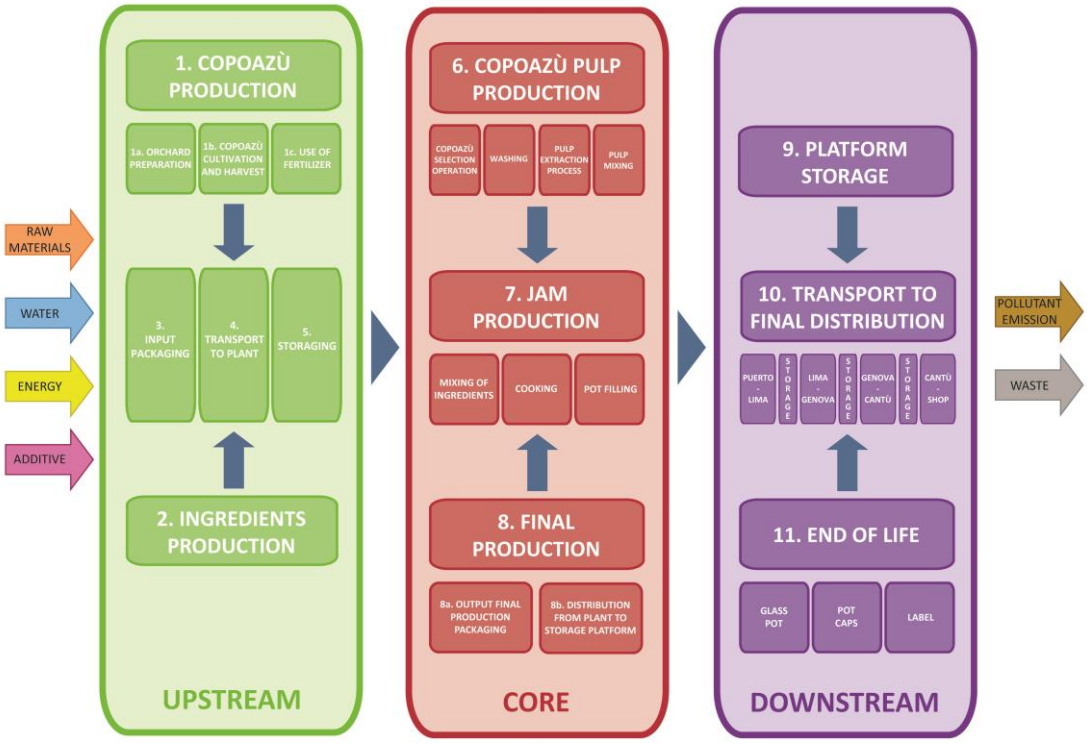

Figure 1 : Flowchart highlighting boundaries of the system

Product	Pots Content	Functional Unit	Pots Number per FU
Cupuaçu Jam (Theobroma Grandiflorum)	212 g	1 kg	4.72

Table 1: Functional unit and reference flow data

Cupuaçu Fruit	Cupuaçu Pulp	Sugar Cane	Cupuaçu Jam
2.28 kg	0.57 kg	0.43 kg	1 kg

Table 2: Cupuaçu jam composition

Upstream	Core	Downstream	Total	UM
0.174	2.120	1.251	3.545	kg CO2 eq
4.91%	59.80%	35.29%	100.00%	%

Table 3: Carbon Footprint of Cupuaçu jam stages

Core			Total	UM
Pulp production	Jam production	Final production		
0.625	0.364	1.131	2,120	kg CO2 eq
29.48%	17.17%	53.35%	100.00%	%

Table 4: Carbon Footprint of Cupuaçu jam – Core stage subdivided according to flowchart scheme in Figure 1

4. Conclusion

Preliminary results of the carbon footprint of Cupuaçu jam are reported in table 3. Agroforestry practices, which constitute the upstream process, have very low impacts with respect to other phases. It is worth noting that the high carbon content in the core process is mainly due to the primary packaging production. As expected, downstream processes are higly affecting because of the long distance necessary for the transportation of the final product to Italy. These conclusions are based on a preliminary analysis that takes into account only one impact indicator and neglects other categories, which, instead, could have important positive benefits deriving from agroforestry practices, such as biodiversity preservation, water saving and social advantages to local populations. These issues will be addressed in future works.

5. References

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