



## METABOLIC PROFILE OF “GUINEO PASO” ARACATACA MAGDALENA COLOMBIA

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### ABSTRACT

**Objective:** The objective of this study is to investigate the social metabolism of the production of "Guineo paso" in Aracataca, Magdalena, in order to analyze its relationship with strong sustainability and food sovereignty in the region.

**Theoretical Framework:** In this section, the main concepts and theories that underpin the research are presented. Social metabolism, strong sustainability, and food sovereignty are highlighted, providing a solid foundation for understanding the context of the investigation.

**Method:** The methodology adopted for this research includes a qualitative and quantitative approach, involving semi-structured interviews with social leaders and the application of the metabolic profile method. Data collection was carried out through interviews and analysis of historical data on biomass appropriation and the number of workers involved in production.

**Results and Discussion:** The results obtained revealed a significant increase in biomass appropriation over the years, rising from 13.8 kilograms in 2000 to 90 kilograms in 2022. In the discussion section, these results are contextualized in light of the theoretical framework, highlighting the implications for sustainability and the resilience of agroecological systems. Possible discrepancies and limitations of the study, such as variability in labor data, are also considered in this section.

**Implications of the Research:** The practical and theoretical implications of this research are discussed, providing insights into how the results can be applied or influence practices in the field of agroecology and food security. These implications may encompass agricultural policies, sustainable production practices, and community resilience strategies.

**Originality/Value:** This study contributes to the literature by offering a detailed analysis of social metabolism in a specific context, highlighting the relationship between agricultural production and sustainability. The relevance and value of this research are evidenced by its ability to inform sustainable practices and public policies that promote food sovereignty and resilience in agricultural communities.

**Keywords:** Ecological Economy, Social Metabolism, Sustainability, Territory.

### PERFIL METABÓLICO DA "GUINÉ PASO". ARACATACA MADALENA COLÔMBIA

#### RESUMO

**Objetivo:** O objetivo deste estudo é investigar o metabolismo social da produção do "Guineo paso" em Aracataca, Magdalena, com o intuito de analisar sua relação com a sustentabilidade forte e a soberania alimentar na região.

**Referencial Teórico:** Neste tópico, são apresentados os principais conceitos e teorias que fundamentam a pesquisa. Destacam-se o metabolismo social, a sustentabilidade forte, e a soberania alimentar, fornecendo uma base sólida para a compreensão do contexto da investigação.

**Método:** A metodologia adotada para esta pesquisa compreende uma abordagem qualitativa e quantitativa, envolvendo entrevistas semiestruturadas com líderes sociais e a aplicação do método de perfil metabólico. A coleta de dados foi realizada por meio de entrevistas e análise de dados históricos sobre a apropriação de biomassa e o número de trabalhadores envolvidos na produção.

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**Resultados e Discussão:** Os resultados obtidos revelaram um aumento significativo na apropriação de biomassa ao longo dos anos, passando de 13,8 quilogramas em 2000 para 90 quilogramas em 2022. Na seção de discussão, esses resultados são contextualizados à luz do referencial teórico, destacando-se as implicações para a sustentabilidade e a resiliência dos sistemas agroecológicos. Possíveis discrepâncias e limitações do estudo, como a variabilidade nos dados de trabalho, também são consideradas nesta seção.

**Implicações da Pesquisa:** As implicações práticas e teóricas desta pesquisa são discutidas, fornecendo insights sobre como os resultados podem ser aplicados ou influenciar práticas no campo da agroecologia e da segurança alimentar. Essas implicações podem abranger políticas agrícolas, práticas de produção sustentável e estratégias de resiliência comunitária.

**Originalidade/Valor:** Este estudo contribui para a literatura ao oferecer uma análise detalhada do metabolismo social em um contexto específico, destacando a relação entre produção agrícola e sustentabilidade. A relevância e o valor desta pesquisa são evidenciados por sua capacidade de informar práticas sustentáveis e políticas públicas que promovam a soberania alimentar e a resiliência nas comunidades agrícolas.

**Palavras-chave:** Economia Ecológica, Metabolismo Social, Sustentabilidade, Território.

## PERFIL METABÓLICO DEL “GUINEO PASO” ARACATACA MAGDALENA COLOMBIA

### RESUMEN

**Objetivo:** El objetivo de este estudio es investigar el metabolismo social de la producción del "Guineo paso" en Aracataca, Magdalena, con el fin de analizar su relación con la sostenibilidad fuerte y la soberanía alimentaria en la región.

**Referencial Teórico:** En este apartado, se presentan los principales conceptos y teorías que fundamentan la investigación. Se destacan el metabolismo social, la sostenibilidad fuerte y la soberanía alimentaria, proporcionando una base sólida para la comprensión del contexto de la investigación.

**Método:** La metodología adoptada para esta investigación comprende un enfoque cualitativo y cuantitativo, involucrando entrevistas semiestructuradas con líderes sociales y la aplicación del método de perfil metabólico. La recolección de datos se realizó a través de entrevistas y análisis de datos históricos sobre la apropiación de biomasa y el número de trabajadores involucrados en la producción.

**Resultados y Discusión:** Los resultados obtenidos revelaron un aumento significativo en la apropiación de biomasa a lo largo de los años, pasando de 13,8 kilogramos en 2000 a 90 kilogramos en 2022. En la sección de discusión, estos resultados se contextualizan a la luz del referencial teórico, destacándose las implicaciones para la sostenibilidad y la resiliencia de los sistemas agroecológicos. También se consideran posibles discrepancias y limitaciones del estudio, como la variabilidad en los datos de trabajo.

**Implicaciones de la Investigación:** Las implicaciones prácticas y teóricas de esta investigación se discuten, proporcionando ideas sobre cómo los resultados pueden ser aplicados o influir en prácticas en el campo de la agroecología y la seguridad alimentaria. Estas implicaciones pueden abarcar políticas agrícolas, prácticas de producción sostenible y estrategias de resiliencia comunitaria.

**Originalidad/Valor:** Este estudio contribuye a la literatura al ofrecer un análisis detallado del metabolismo social en un contexto específico, destacando la relación entre la producción agrícola y la sostenibilidad. La relevancia y el valor de esta investigación se evidencian por su capacidad para informar prácticas sostenibles y políticas públicas que promuevan la soberanía alimentaria y la resiliencia en las comunidades agrícolas.

**Palabras clave:** Economía Ecológica, Metabolismo Social, Sostenibilidad, Territorio.

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## 1 INTRODUCTION

The territory of Aracataca is located in the Caribbean Region of the Colombian state, in South America. Its area is 1,985 km<sup>2</sup>, which represents 8.5% of the territory of the department of Magdalena (Rendón and Gómez, 2022). In population terms, with 2018 data, women constitute 49.4% of the population (20,486 individuals) and men 50.6% (21,006 persons). Similarly, the urban population represents 60.36%, while the rural population is 39.64%. In addition, due to its ethnic mix, the total population also includes 6.87% of people who recognize themselves as Afro-descendants, 8.2% as indigenous and approximately 16.7% as roots (Alcaldía de Aracataca 2020-2023, 2020; DANE, 2018a; 2018b).

From the socioeconomic point of view, in 2013, the territory represented 2.1% of the GDP of the department of Magdalena. The economic portfolio is divided into 52.46% of added value, where agriculture occupies second place with 22%, and the exploitation of raw materials contributes with another 22.60%. The local economy is characterized by informality, with more than 60% of the Economically Active Population (EAP) working informally, and by agriculture (Alcaldía de Aracataca Magdalena, 2020-2023, 2020; DANE, 2018c).

In socio-environmental terms, the city of Aracataca has an average altitude of 40 meters above sea level, with a warm climate of about 20 degrees Celsius. The climate features tropical rainforest, with an average annual precipitation of 1,345 mm, annual radiation between 2,100 and 2,400 hours of light, and an estimated relative humidity between 82% and 87% (Daabon, 2017). The region's biodiversity includes three major biomes: tropical forest (48.3% of the territory), tropical desert forest (0.5%) and tropical rainforest (51.1%) (Gómez, 2022a; CORPAMAG, 2013a; 2013b).

Specifically, Aracataca is an area with high levels of poverty when compared to the rest of the department and the country. However, the region also possesses significant biological wealth, which has been dilapidated by several socioeconomic variables, including the cultivation of palm oil and rice (INVEMAR and CORPAMAG, 2018; Contraloría General del Departamento del Magdalena, 2017; Cotes, 2016). Thus, this study has the general objective to quantitatively analyze, from the perspective of strong sustainability, the social metabolism of the product "Guineo Passo" in the territory of Aracataca, Magdalena, using the method of metabolic profile (Crespo and Pérez, 2019), considering the years 2000, 2016 and 2022.

‘Guineo Passo’ is a dessert derived from plantain or banana, abundant in the Caribbean Region of Colombia. This dish is part of the gastronomy of the territory and territoriality of the department of Magdalena, although it is also common in other parts of the country (Vidal, 2014;



Bermúdez, 2012). The production process of "Guineo Passo" involves maturing the plantain or banana and drying it in the sun to obtain the final product (ETC, 2023). It is important to note that plantain contains vitamins A, B1, B2, C and E, as well as tannins, zinc, phosphorus, iron, potassium and magnesium (Horie et al., 2020; Kauri et al., 2020; Kumar et al., 2019). It is worth noting that the Colombian government has prioritized the cultivation of different varieties of plantain as part of strategic productive chains for technological development and innovation, due to their economic importance and nutritional value (Ministry of Agriculture and Rural Development, 2020; Mosquera et al., 2011).

Consequently, this article begins with an introduction, followed by a description of the theoretical framework where the analytical categories are detailed. Afterwards, one addresses the characterization of the methodology and of the method, going on to the results of the research, and, finally, the discussion of these results, with brief conclusions. The central hypothesis is that the social metabolism between the production of "Guineo Passo" and the territory of Aracataca, Magdalena, is in line with the principles of strong sustainability.

## **2 THEORETICAL FRAME**

### **2.1 SOCIAL METABOLISM - MS**

The MS can be understood as a consonance between the relations of nature with human societies. Its objective is to measure qualitatively and quantitatively the exchange of materials and energy between territories, groups, societies and natural capital. Precisely, every human action generates an environmental cost and, therefore, human actions with nature are of a socio-ecological nature. (González de Molina et al., 2020; Infante et al., 2017; González de Molina, 2016). The MS is analyzed from five metabolic processes: (A) appropriation, (T) transformation, (D) distribution, (C) consumption and (E) excretion (Caixeta, Girardi & Ribeiro, 2018). For the present study, the process of (A) Appropriation is adopted, which is understood as the process by which human groups obtain energy and materials from natural capital for their existence and reproduction. An Appropriation Unit (A) can be associated with a territory, an individual, a social group, etc. (Gómez, 2022a; 2022b; López and Toledo, 2018).



## 2.2 TERRITORY

The territory is the social construction of a geographical area delimited by the executive. On the other hand, Territoriality refers to the way in which the residents of a territory subjectively and intersubjectively appropriate a geographical space (Galafassi, 2020; Raffestein, 1980).

## 2.3 STRONG SUSTAINABILITY - SF

According to the science of sustainability, environmental sustainability is understood to be the ability of socio-ecological systems to adapt to disturbances (Salas, 2012; Gallopin, 2006). It is divided into two branches: Weak Sustainability, which states that manufactured capital can replace services provided by natural capital, and Strong Sustainability, which establishes the opposite. The latter is the line of argument in this text (Correa, 2017).

## 3 METHODOLOGY

The research is divided into two methodologies. On the one hand, it is qualitative, and the method used were semi-structured interviews with social leaders of the territory and territoriality of Aracataca, Magdalena. The data collection instrument was validated by a statistician and an expert in the field. Similarly, a triangulation between analytical and emerging categories was performed (Gómez, 2022a; Barbosa et al., 2020; Paramo, 2008; Pérez, 1998; Rojas, 1996). Secondly, a quantitative methodology was used, using the method called metabolic profile, applied for three specific years: 2000, 2016 and 2022 (Gómez, 2022b; Reina, 2016; Annex 1; Annex 2).

The development of metabolic profiles for certain years was determined by the asymmetry of information, and clear data on Appropriation is imperative (Crespo & Pérez, 2019). It was also necessary to make comparisons over time (Reina, 2013). Although there are several methods to measure strong sustainability, such as energy flow accounting (EFA) (Ayres & Knees, 1969), net primary productivity (HANPP) (Vitousek et al., 1986), ecological footprint (Amen et al., 2011) and Material & Energy Flow Accounting (MEFA) (González de Molina, 2016), the available data were not robust enough. The use of these methods could result in the overvaluation or undervaluation of the results. The metabolic profile method, however, is the most consistent, as it adapts to reality, rather than forcing reality to adapt to methods.



Taking as a guideline the temporality for the historical-environmental analysis, the period 2000-2016 was selected, based on the biomass extracted annually from the "Guineo Passo" or banana. The calorie power of the workers involved in the product's development was also analyzed. The units used were the British Thermal Unit (BTU) and the joule, according to international standards. Gimpetro & Pimentel (1990) state that the power of an adult is 90 watts or 0.12 HP (Horse Power) per hour, while the American Physical Society (1996) defines that 1 HP equals 2544.33 BTU (Gómez, 2022a; Amorocho, 2000; Delgado, Salgado e Pérez, 2015; Reina, 2013).

It is important to clarify that only six months of the year were considered due to the bimodal rainfall of Aracataca, Magdalena, i.e. six months of cloudiness or rain and six months of strong solar radiation (Rendón and Gómez, 2022). In addition, the number of workers and the number of hours worked per day in the production of ‘Guineo Passo’ was identified.

#### 4 RESULTS AND DISCUSSIONS

**Table 1**

*Biomass Allocation*

Year	Number of bananas or guineos paso <sup>2</sup>	Biomass extraction
2000	92	150 grams *92 = 13.8 Kilograms
2016	300	150 grams *300 = 45 Kilograms
2022	600	150 grams *600 = 90 Kilograms

Source: Semi-structured interview of the field work year 2022-2023.

**Table 2**

*Characterization of workers*

Year	Number of employees	Number of hours worked per day	Number of days worked
2000	2.	6	180
2016	8	6	180
2022	2.	6	180

Source: Semi-structured fieldwork interview in 2023.

<sup>2</sup> A banana weighs about 150 grams.



Taking as a guideline the three years in which it was possible to objectively verify the number of workers, the number of hours worked and the number of days worked per year, it can be observed that, over time, in the environmental horizon from 2000 to 2022, there was an expansion in Biomass Appropriation. In this sense, the appropriation went from 13.8 kilograms in 2000 to 90 kilograms in 2022.

Year 2000

Heat released per hour (BTU/h):

Mathematical identity 1:

Heat released per hour (BTU/h) =  $0.12 \text{ HP} * 2544.43 \text{ BTU} = 305.33 \text{ BTU/h}$ .

Mathematical identity 2:

Therefore, the heat released in one hour of work is 305.3319867 BTU/h.

Calculation of the released heat per daily day:

The heat released during a daily working day is multiplied by 6 hours.

Heat released per day (BTU/day) =  $305.3319867 \text{ BTU/h} * 6 \text{ hours} = 1831.9919202 \text{ BTU/day}$ .

Calculation of the heat released by 6 months (180 working days):

Mathematical identity 3:

In one year, you work 180 days.

Heat released in 6 months (BTU/180 days) =  $1831.9919202 \text{ BTU/day} * 180 \text{ days} = 329758.545636 \text{ BTU}$ .

Mathematical identity 4:

If two employees work during the same period, the heat released is twice as hot.

Heat released per year for two employees (BTU/180 days) =  $329758.545636 \text{ BTU} * 2 = 659517.091272 \text{ BTU}$ .

Mathematical identity 5:

Total heat released by two employees in one year: 659517,091272 BTU (Gómez, 2022a; Reina, 2013).

So on for each of the years.

**Table 3***Summary of released heat*

<b>Year</b>	<b>Daily work day for 6 hours</b>	<b>180 days.</b>	<b>By the number of employees</b>
2000	1831.9919202 BTU/hr	329758.545636 BTU/hr	659517.091272 BTU/hr
2016	1831.9919202 BTU/hr	329758.545636 BTU/hr	2638068.36509 BTU/hr
2022	1831.9919202 BTU/hr	329758.545636 BTU/hr	659517.091272 BTU/hr

Source: Own preparation

Similarly, to quantify the energy flow and complete it for each of the metabolic profiles described (Gómez, 2022a; 2022b; Reina, 2013), the daily working day, the number of days worked per year and the number of workers were identified. The data was collected during the fieldwork carried out between 2022 and 2023. Social leader (1), 2022; Social leader (2); Social leader (3); Social leader (4), 2023).

In short, qualitative and quantitative data suggest that the greater the number of workers, the greater the heat released. Similarly, it is noted that a higher number of workers does not necessarily imply a higher Biomass Ownership. Consequently, the metabolic profile of the three years characterized, as well as the production method of ‘Guineo paso’, are in line with strong sustainability (Correa, 2017; Maldonado, 2017; 2014; Neumayer, 1999).

Agroecology explicitly recognizes its contribution to resilience. Thanks to the functional balance maintained by agro-ecological systems, these systems have a greater capacity to prevent threats present in the agro-food system and to absorb those that cannot be avoided. These two elements are central to building resilience, along with the capacity for adaptation, transformation and anticipation (Guzmán and González de Molina, 2017). In particular, the "Guineo paso", according to the data of the methodology and methods used, reflects a strong sustainability that is aligned with the postulates of agroecology (Mier et al. 2018; Maldonado, 2018).

For the same purpose, the metabolic profile of "Guineo paso" production is in line with Food Sovereignty, as this is the right of peoples, communities and countries to define their own agricultural, labor, fisheries, food and land use policies in an environmentally, socially, economically and culturally appropriate manner to their unique circumstances. This includes the true right to food and food production, which means that everyone has the right to safe, nutritious and culturally adequate food, as well as the resources to produce food and the ability to sustain themselves and their societies (CIP, 2020; IICA, 2012).



Thus, peasant organizations, in this specific case, the Aracataca Cultural Tourism Entrepreneurs Association, with NIT 901740179-2, which includes among its products the "Guineo paso", registered on August 3, 2023, can combat food insecurity. Both the territory and the territoriality of Aracataca, Magdalena, Colombia have realized that it is not only a question of guaranteeing a determined production of food to ensure access to food per person, but also of considering what food is produced, how and on what scale. Therefore, food sovereignty involves a systemic change in which human beings have direct and democratic control over the most important elements of society, such as food, land use, water and other environmental resources, for the benefit of present and future generations, and over how they interact with other groups, people and cultures (Gibson, 2012; CLAC-Fairtrade, 2019; Figueroa, 2005). In fact, the exchange of energy and materials in the production of "Guineo paso" is aligned with these postulates (Delgado, 2014; Dematteis e Governa, 2005).

Similarly, the results of this article are in line with (Fischer-Kowalski, 2011; Eisenmenger et al., 2007), which advocate the need to change the energy and material exchange regimes that are synchronized with extraction without taking into account territory and territoriality. Specifically, the production of 'Guineo paso', by using energy not derived from fossil combustion, contributes to mitigating the biophysical cost of human activity in producing this product. In addition, the article dialogs with the postulates of (Maldonado, 2023; Noguera and Ramírez, 2023; Carrizosa, 2023; Farrell, 2023), which state that the energy transition cannot be based on a "domesticated bioeconomy" institutionally subscribed by multilateral entities and captured by states. Instead, this transition should be driven from the bottom up, taking into account culture, history, traditions, territories, territorialities and the relationship between communities and the environment or, in more economic terms, natural capital and its symbolic capital, since human action does not develop in an ontological void.

## 5 CONCLUSION

The metabolic exchange between the production of 'Guineo paso' and the territory and territoriality of Aracataca is inscribed within the principles of strong sustainability. In fact, the way in which energy is obtained, as well as the ownership of biomass over the years, quantified and qualified, is in line with these fundamentals, favoring sovereignty and food security.

"Guineo paso" is a product that redeems the ancestral knowledge of the Colombian Caribbean region. It is in line with agroecology, as it emphasizes primarily human and social values such as dignity, equity, inclusion and justice. In particular, 'Guineo paso' prioritizes the



needs and interests of actors in the agri-food chain (food producers, distributors and consumers). In addition, ‘Guineo paso’ contributes to healthy, diverse and culturally appropriate diets. Therefore, ‘Guineo paso’ favors food security and nutrition while preserving the health of ecosystems.

The socio-ecological transition is in line with the needs and possibilities of the territory and territoriality. The "Guineo paso", being a product of Colombian gastronomy, represents culture and history, helping to reconfigure the social fabric. To enrich studies of social metabolism through one of its variables, such as Appropriation, it is necessary to expand qualitative and quantitative data and use other measurements, both from strong sustainability and weak sustainability. However, this would be beyond the scope of the present work, due to the large information asymmetries and public order problems in the territory. However, it opens up a field of possibilities for studying and building a society in harmony with nature.

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