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Collective action and social metabolism: territorial sustainability experiences in Ecuador and Nicaragua

Acción colectiva y metabolismo social: experiencias de sostenibilidad territorial en Ecuador y Nicaragua

Ação coletiva e metabolismo social: experiências de sustentabilidade territorial no Equador e na Nicarágua

José Efraín ASTUDILLO BANEGAS¹, Sonia Catalina SIGÜENZA-ORELLANA^{1*}, Francisco Xavier GONZÁLEZ JIMÉNEZ¹

¹ Universidad de Cuenca (UCUENCA), Cuenca, Provincia del Azuay, Ecuador.

* Contact e-mail: soniac.siguenza@ucuenca.edu.ec

Article received on February 27, 2025, final version accepted on July 15, 2025, published December 5, 2025.

ABSTRACT The conventional development model, focused on economic growth, has generated exploitation and environmental degradation. In parallel, experiences that propose new relationships between humans and nature, where collective action influences social metabolism and promotes alternative forms of territorial sustainability, are resisting. In this context, this study seeks to examine the interrelationship between social metabolism and collective action in the Association of Agroecological Producers of Azuay (APA Azuay), Ecuador and the Center for Understanding with Nature (CEN), Nicaragua. These experiences seek a situated sustainability, built from peasant, indigenous and Afro-descendant communities; from women and youth. They prioritize care, environmental justice, and territorial autonomy, in contrast to the extractivist and centralized logics of conventional development. For this purpose, a qualitative methodology was used, using interviews, focus groups, workshops and documentary review. The results show that collective action is based on shared decision-making, a situation that affects the social metabolic process. This process allows for sustainable management of local resources, based on reciprocity, care and co-responsibility, which together strengthen territorial sustainability. The conclusion is that it is possible to configure a social metabolism in which energy and matter are appropriated, transformed, used, distributed and, in certain cases, recycled in a way that favors

the reproduction of life and ecosystemic balance. This type of metabolism, derived from forms of collective action, can contribute to fairer and more regenerative processes of territorial sustainability.

Keywords: collective action; social metabolism; territorial sustainability; local experiences.

RESUMEN

El modelo de desarrollo convencional, centrado en el crecimiento económico, ha generado explotación y degradación ambiental. En paralelo, resisten experiencias que proponen nuevas relaciones entre humanos y naturaleza, donde la acción colectiva influye en el metabolismo social y promueve formas alternativas de sostenibilidad territorial. En este contexto, este estudio busca examinar la interrelación entre el metabolismo social y la acción colectiva en la Asociación de Productores Agroecológicos del Azuay (APA Azuay), Ecuador y el Centro de Entendimiento con la Naturaleza (CEN), Nicaragua. Estas experiencias buscan una sostenibilidad situada, construida desde las comunidades campesinas, indígenas, afrodescendientes; desde las mujeres y juventudes. Priorizan el cuidado, la justicia ambiental y la autonomía territorial, en contraste con las lógicas extractivistas y centralizadas del desarrollo convencional. Para ello se recurrió a una metodología cualitativa, utilizando entrevistas, grupos focales, talleres y revisión documental. Los resultados evidencian que la acción colectiva se fundamenta en la toma de decisiones compartidas, situación que incide en el proceso metabólico social. Este proceso permite una gestión sostenible de los recursos locales, basada en la reciprocidad, el cuidado y la corresponsabilidad, lo que en conjunto fortalece la sostenibilidad territorial. Se concluye que es posible configurar un metabolismo social en el cual la energía y materia son apropiadas, transformadas, utilizadas, distribuidas y, en ciertos casos, recicladas de manera que favorezcan la reproducción de la vida y el equilibrio ecosistémico. Este tipo de metabolismo, derivado de formas de acción colectiva, puede contribuir a procesos de sostenibilidad territorial más justos y regenerativos.

Palabras clave: acción colectiva; metabolismo social; sostenibilidad territorial; experiencias locales.

RESUMO

O modelo de desenvolvimento convencional, centrado no crescimento econômico, tem gerado exploração e degradação ambiental. Em paralelo, resistem experiências que propõem novas relações entre seres humanos e natureza, onde a ação coletiva influencia o metabolismo social e promove formas alternativas de sustentabilidade territorial. Nesse contexto, este estudo busca examinar a inter-relação entre metabolismo social e ação coletiva na Associação de Produtores Agroecológicos do Azuay (APA Azuay), no Equador, e no Centro de Entendimento com a Natureza (CEN), na Nicarágua. Essas experiências buscam uma sustentabilidade situada, construída a partir das comunidades camponesas, indígenas e afrodescendentes; das mulheres e das juventudes. Priorizam o cuidado, a justiça ambiental e a autonomia territorial, em contraste com as lógicas extrativistas e centralizadas do desenvolvimento convencional. Para isso, recorreu-se a uma metodologia qualitativa, com uso de entrevistas, grupos focais, oficinas e revisão documental. Os resultados evidenciam que a ação coletiva se fundamenta na tomada de decisões compartilhadas, o que incide diretamente no processo metabólico social. Esse processo permite uma gestão sustentável dos recursos locais, baseada na reciprocidade, no cuidado e na corresponsabilidade, o que, em conjunto, fortalece a sustentabilidade territorial. Conclui-se que é possível configurar um metabolismo social em que a energia e a matéria são apropriadas, transformadas, utilizadas, distribuídas e, em alguns casos, recicladas de forma a favorecer a reprodução da vida e o equilíbrio ecossistêmico. Esse tipo de metabolismo, derivado de formas de ação coletiva, pode contribuir para processos de sustentabilidade territorial mais justos e regenerativos.

Palavras-chave: ação coletiva; metabolismo social; sustentabilidade territorial; experiências locais.

1. Introduction

The conventional development model, monolithic and focused on economic growth, has led to environmental exploitation and degradation. This approach, based on a homogeneous vision of progress and well-being, assumes that economic development, measured primarily by Gross Domestic Product (GDP), is the primary indicator of prosperity. This situation implies that all societies must follow a similar path to development, based on industrialization, urbanization, and market expansion, ignoring the cultural, ecological, and social diversity of different communities and imposing a single model for all contexts (Escobar, 2017; Carvallo & Calvo, 2019).

In response to this model, proposals that seek to contribute to the sustainability of life have emerged. From this perspective, Escobar (2017) proposes a transformative vision of sustainability, based on the recognition and appreciation of the diverse forms of knowledge and life that exist in the world. This approach advocates profound transformations in ways of thinking and acting, in addition to valuing and revitalizing ancestral knowledge and territorial practices that have sustained Indigenous, peasant, and Afro-descendant communities for centuries. It also promotes a reconfiguration of power relations, challenging the structures that perpetuate exploitation and inequality and fostering collaborative and inclusive forms of governance.

In this context, authors from the Vienna School of Social Ecology, such as Helmut Haberl and Marina Fischer-Kowalski, adopted the concept of social metabolism as a process that analyzes the

management and transformation of materials and energy flows within a society to provide services and benefits. In their work “Socioeconomic Metabolism”, these authors developed the concept of socioeconomic metabolism as an analytical tool for understanding the physical relationships between society and nature. They approach it from a historical and comparative perspective between hunter-gatherer, agricultural, and industrial societies, and link this metabolism with strategies of “colonization of nature”, framed within processes of sustainable development and ecological limits (Fischer-Kowalski & Haberl, 2000). From this perspective, it is stated that these processes affect and are affected by daily practices and socioeconomic relations (Haberl *et al.*, 2021), allowing us to “understand the socio-environmental transformations of the territory and society” (Cervantes Rendón *et al.*, 2023, p. 179).

Meanwhile, collective action, understood as the collaboration and organization of individuals and communities to manage and resolve common problems, facilitates the transformation of social and cultural practices. Thus, understanding collective action and social metabolism are fundamental to the sustainable management of natural resources and to promoting practices that foster resilience and ecological justice (De Sousa Santos, 2014; Gudynas, 2015a; Gudynas, 2015b; Escobar, 2017).

Within this framework, this research aims to examine how the relationship between collective action and social metabolism, in specific territorial contexts, can contribute to the formation of sustainable territorial experiences. To this end, specific objectives are proposed: to analyze two Latin

American case studies based on the aforementioned dimensions, and to compare the fundamental elements that make the presented case studies sustainable alternatives to the current economic and political-institutional system.

As a hypothesis, based on the literature reviews, it is proposed that the relationship between collective action and social metabolism allows us to understand and promote sustainability in specific experiences.

2. Theoretical framework

2.1. Social Metabolism: theoretical instrument for the analysis of natural and social processes

Social metabolism, from the perspective of socioecological theory, explores the interdependence between society and nature. It is conceptualized as “a powerful theoretical tool for jointly analyzing the relationships between natural and social processes” (Toledo, 2013, p. 42). Therefore, the metabolic process begins when socially organized human beings appropriate matter and energy from nature (input) and culminates when these are returned to the environment in the form of waste (output) (Toledo, 2013).

Between the input and output processes, there are five stages: First, appropriation, the act by which society extracts materials, energy, water, and services from nature to satisfy its biological and social needs; second, transformation, a process that involves modifying the extracted natural resources;

third, circulation occurs when the appropriation units stop consuming and producing everything they consume; and fourth, consumption, a phenomenon that involves the entire society, which uses the products obtained in the previous processes. Thus, output corresponds to the moment of excretion or return of materials and energy to nature in the form of waste (Toledo, 2013).

Social metabolism as a system offers a conceptual framework and a methodology for the analysis of flows articulated in both tangible and intangible aspects (Cordón & Toledo, 2013), allowing us to understand how organizations manage resources through practices, strategies, consumption and production patterns that could generate synergistic relationships, socioeconomic and cultural structures that prioritize balance and harmony between nature and human beings.

It is important to mention that, while social metabolism allows us to qualify the magnitude of society-nature interactions, it does not per se guarantee sustainability. In the words of Haberl *et al.* (2004, p. 195), “although it is plausible that increases in the flow of materials and energy are detrimental to sustainability [...], much remains to be done to establish an explicit link between socioeconomic metabolism and sustainability”. Therefore, its analysis must include not only biogeochemical flows but also the social, cultural, and ethical aspects associated with the transformation of nature by human societies.

2.2 *Collective action for alternative experiences*

Society is used to viewing collective actions in terms of cost-benefit. In this sense, Olson (1985, p. 213) states that: “before investing a large amount of money or time (...), the rational individual will reflect on what they will achieve through that considerable sacrifice”.

Consequently, incentives allow individuals to unite, beyond their particular interests, seeking to resolve certain interests that are not commonly addressed by the State and its institutions. However, the incentives in sustainable experiences go beyond the economic aspect, where certain aspects become determining, such as: community participation, social organization, autonomy, social justice, fair trade, inclusion, everyday democracy, environmental protection, solidarity and community strengthening, areas of personal and collective life, which the current system does not allow to develop in harmony, in this sense, “collective action is always the result of a tension that disturbs the balance of the dominant social system” (Melucci, 1999, p. 26).

Alternatives to the current system are often analyzed as a consequence of “structural crises, contradictions, or as an expression of shared beliefs and orientations” (Melucci, 1999, p. 36). The first analytical position comes from a Marxist and structuralist perspective; the second is common in countries of the South, where shared beliefs and visions predominate. However, collective action that promotes sustainability is much more complex than these dualities (Morales Gil de la Torre, 2017).

In this sense, according to Melucci (1999, p. 37), “action must be considered as an interaction of objectives, resources and obstacles, as an intentional orientation established within a system of opportunities and constraints. Movements are systems of action that operate in a systemic field of possibilities and limits”. Therefore, collective actions that are consolidated in social and citizen movements, cooperatives, producer associations and, that at the same time promote territorial sustainability (Olvera Salinas, 2017), function as a complex system of relationships (Barrera Guarderas, 2001).

This concept highlights a fundamental characteristic that motivates people to take collective action: the need to conserve and defend the commons, after having experienced hardship, scarcity, and lack of access to common resources. Therefore, a certain consensus causes humanity and the Earth itself to react in a way that defends the harmony of life. In this regard, Ostrom (1990, p. 43) asks:

What can we learn from experience to help us stimulate the development and use of a better theory of collective action – a theory that identifies the key variables that can enhance or diminish individuals’ problem-solving abilities?

This questioning by Ostrom is the central axis of this article. Its purpose is to identify elements of the daily lives of people and their organizations that make their life practices be alternatives to the current economic and political-institutional system, not by simple opposition, but because life is sustained in a more just and balanced way (Astudillo Banegas, 2018), compared to systems that have only

considered economic growth by exercising politics through governments whose power is authoritarian.

3. Methodology

The research adopted a qualitative exploratory-descriptive methodology, using case studies as its primary method. A multiple-case analysis focused on processes of collective action and social metabolism geared toward territorial sustainability in Ecuador and Nicaragua was developed. The units of analysis were two specific experiences: the Azuay Agroecological Production Association (hereinafter APA Azuay), in Ecuador, and the Center for Understanding Nature (CEN), in the Peñas Blancas Massif, Nicaragua. These cases were selected for their emblematic nature, as proposed by Flvbjerg (2006), as they allow for an in-depth understanding of complex social processes based on an empirical and reflective basis. In particular, they offer important aspects for analyzing the dynamics of social metabolism and extracting useful lessons for their study and application in other contexts.

From this perspective, the analyzed cases present experiences that align with the theoretical framework, establishing a coherent connection between theory and practice. These are important cases, selected for their contextual diversity and their potential to facilitate an exploration of social action and social metabolism linked to sustainability. Although they do not seek to statistically represent a broad universe, they are representative, illustrating practices that can illuminate and motivate new experiences. Furthermore, they were chosen for their accessibility and data availability.

The study population corresponds to the groups of people who make up these organizational experiences. To ensure the ethical rigor of the research, informed consent was obtained from the participants, in accordance with the principles of confidentiality, voluntariness, and respect for autonomy. The data collection techniques included documentary analysis, focus groups, semi-structured interviews, and participatory workshops. Fieldwork was conducted over a six-month period, between June and November 2024.

Document analysis. In the case of CEN, three dissemination documents that present the systematization of its experience were analyzed. These were provided by its institutional representative, with whom an interview was held via Zoom.

Focus group. In the case of the APA Azuay Association, a focus group was held with the participation of eight people representing various agroecological initiatives, with the objective of collecting relevant information for the study. The participants were: directors, technicians (one from the Ministry of Agriculture and another from the Institute of Popular and Solidarity Economy), and one representative from academia. For the implementation of the focus group, a script was structured based on the theoretical framework and the categories to be investigated.

Participatory workshop. Two workshops were held with the participation of 10 founding members, 10 new members, and 14 members representing each region of the Azuay Producers Association. The workshops were held both in the territories where the members produce and at the headquarters

located in the Miraflores Market in Cuenca, where they sell their products.

Semi-structured interviews. In both the case of APA Azuay and CEN, semi-structured interviews were conducted with members of each organization who met the following selection criteria: holding a representative position, having a long history within the collective, and representing gender diversity. In total, three people were interviewed for APA Azuay and one person for CEN. An interview script was developed, and informed consent was obtained beforehand. The interviews were conducted in person and via the Zoom platform.

Two main techniques were used for data analysis: thematic content analysis and comparative analysis. These tools allowed for the identification of patterns, categories, and significant relationships within the collected information. This enabled a deeper study of key concepts: collective action, social metabolism, and territorial sustainability, as well as their interrelationships in the analyzed cases. A fundamental phase of the methodology was the feedback to the participants, carried out both through written reports sent for validation and in workshops and meetings focused on the topic.

4. Results

4.1. Case study in Ecuador: Association of Agroecological Producers of Azuay

The APA Azuay Association is a local initiative linked to agroecological production in the province

of Azuay, Ecuador. It connects rural families committed to environmental care, human health, and ancestral knowledge. The APA Azuay Association was established in 1995 with the participation of 20 agroecological producers, mostly women. Its objective was to act together in order to access marketing opportunities. This association is characterized by its commitment to agroecology, from its productive perspective and as a movement that contributes to the politics of food sovereignty, fair trade, and social justice (Woman, 47 years old, leader of APA Azuay).

The analysis of this case study through the dimensions of collective action reveals that APA Azuay represents an example of self-organization, participation, resistance, resilience, and transformation. Despite having worked in a context with several limitations, this experience has demonstrated a great capacity to bring people together with a shared goal, willing to question existing power structures and promote more sustainable forms of organization. In this case, collective action becomes a key tool for achieving goals that could not be achieved individually.

APA Azuay demonstrates a strong collective identity based on principles such as agroecology, social justice, and respect for the environment, which has contributed to strengthening internal cohesion and motivated collaborative work to achieve common goals, even in adverse circumstances. Furthermore, it has established an organizational structure that promotes participatory democracy through a governance system comprised of a general board, a board of directors, an oversight board, and regional coordination committees, all with the goal of ensuring that all voices are heard in the decision-

-making process, strengthening the organization's legitimacy and sustainability.

A key aspect that has stood out at APA Azuay is its remarkable capacity for adaptation and resilience, which has allowed it to overcome various limitations, such as a lack of marketing space, insufficient resources, health crises, economic problems, and adverse weather conditions. In the face of these challenges, they have collaborated to find solutions.

The ability to innovate and its commitment to self-management have allowed APA Azuay to build its own headquarters. For its members, this place is a center of identity and collective efforts. APA Azuay has launched innovative projects, highlighting initiatives such as the Native Seed House, a project that promotes the preservation of agricultural biodiversity and ancestral knowledge, focusing on the collection and transmission of traditional knowledge related to the production, harvesting, and use of native plants.

This space promotes the right to conserve and manage native seeds, which contributes to reducing dependence on external resources. Symbolically, the seed house is a space of resistance to the controlling practices and policies of dominant production models; it is a living symbol of identity, resistance, and commitment.

APA Azuay presents itself as a collective action initiative that shapes a social metabolism with a significant impact on territorial sustainability. According to Toledo (2013), the information provided by its members reveals that its social metabolism process is based on a phenomenon of appropriation that prioritizes sustainability and self-sufficiency. This approach involves the use of materials, ener-

gy, water, and natural services to transform the economic, environmental, and social dynamics of its community.

The APA Azuay organization is significantly committed to the conservation of native seeds, protecting approximately 150 local varieties that constitute an essential asset for the region's biodiversity. Regarding energy, its strategy focuses on the use of natural resources and human effort, with the goal of minimizing dependence on external sources. This is consistent with data from CAN (2011), which indicates that family farming, which maintains agroecological practices, is more energy-efficient than conventional agriculture. The latter has higher economic returns but greater polluting energy consumption. Thus, it ensures that its production is sustainable and consistent with practices that promote environmental care and protection.

The organization protects the services provided by nature, especially wetlands and local bodies of water, essential elements for maintaining ecological balance, air purification, and providing fresh water for the community. In this regard, its representatives state that "we take from our environment only what is necessary for production, avoiding excessive use of the resources that nature offers us" (Woman, 47 years old, leader of APA Azuay).

The transformation process promoted by APA Azuay focuses on agroecological production methods based on five essential principles: agroforestry, soil protection and care, biodiversity, responsible water use, and recycling and reuse. These are complemented by two cross-cutting principles that enrich all of its activities: the use of local resources and the incorporation of ancestral knowledge.

This transition toward sustainable production adds value to its products and meets the needs of the community.

The circulation process in APA Azuay is based on the establishment of local networks that strengthen the connection between producers and consumers. Although most producers focus on meeting their own needs, any surplus produced is sold in local markets. For its representatives, the market is “considered an instrument to facilitate marketing, but not an ultimate goal for achieving economic benefits by dominating decisions and policies” (Woman, 47 years old, leader of APA Azuay).

These marketing networks have been established through collaborations with various local institutions and are supported by communication and organizational strategies that eliminate the need for intermediaries. By facilitating direct connections between producers and consumers, they ensure that the economic benefits remain in the community, fostering a solidarity economy that transcends the simple transaction. Furthermore, this local circulation approach supports food sovereignty, allowing consumers to access fresh, quality products grown in their own environment. In this way, APA Azuay promotes a more equitable economy, strengthens the social fabric, and strengthens the connection to the land, articulating agroecological practices that integrate economic sustainability, strong community relations, and respect for natural cycles.

The consumption process at APA Azuay is fundamental, as it establishes a direct link between consumers and the agroecological products generated through their production, processing, and distribution practices. This consumption satisfies the

community’s food needs and promotes and strengthens agroecological production. Its representatives emphasize that “we produce for consumption, not for consumerism” (Woman, 47 years old, leader of APA Azuay).

When local consumers choose foods that are free of agrochemicals and produced sustainably, they are fostering demand for healthy options and promoting essential principles such as self-sufficiency and food sovereignty.

This type of consumption emerges as a conscious response to social and cultural needs, establishing a close and meaningful connection between producers and consumers. Through direct sales in local markets and social media promotion, APA Azuay facilitates access to fresh, natural foods, boosting the local economy and strengthening the community’s social and environmental well-being.

APA Azuay’s waste management process adopts a sustainable approach to managing the waste generated by its activities. This involves reintegrating materials and energy into the environment in an environmentally friendly manner. To ensure that the waste is of high quality and suitable for effective recycling, APA Azuay implements practices such as composting and biomass recycling. These actions allow crop nutrients to be reintegrated into the soil, improving fertility and promoting ecosystem regeneration.

The organization manages the amount of waste, opting for reusable packaging in tune with the environment’s capacity to absorb and recycle, contributing to reducing environmental impact by implementing transformation processes that require little external energy. This comprehensive

approach ensures that waste is managed in a way that aligns with natural cycles, promoting agroecological production that respects the limits of the ecosystem and fosters a balanced relationship with the environment.

In this regard, its representatives state that, “we reduce, reuse, and recycle all the waste we generate, because for us, these are resources that, when properly managed, are reintroduced into the production cycle” (47-year-old woman, leader of APA Azuay). The different stages of the social metabolic process carried out by APA Azuay reflect a production method committed to environmental balance at every stage, from resource utilization to waste management.

Through practices such as native seed conservation, renewable energy use, chemical-free product development, and responsible waste management, APA Azuay produces healthy, high-quality food, playing a crucial role in soil regeneration, biodiversity conservation, and strengthening local food sovereignty.

This initiative is supported by the Organic Law of the Food Sovereignty Regime, which recognizes agroecology as a legitimate form of agricultural production, prioritizing its promotion in agricultural development programs and public procurement (Martinez & Zárate, 2020). Furthermore, mechanisms such as Participatory Guarantee Systems (SPG), officially recognized as an alternative to organic certification, have been implemented, facilitating small agroecological producers’ access to local markets and short circuits (Pino Andrade, 2017). These frameworks strengthen collective processes

by coordinating production and regulation under principles of sustainability and equity.

4.2. Case study in Nicaragua: Center for Understanding Nature – CEN Macizo de Peñas Blancas. BOSAWAS

In northern Nicaragua lies the Bosawás region, declared a Biosphere Reserve by the United Nations Educational, Scientific and Cultural Organization (UNESCO) in 1997. It is an important protected area in Central America, as it forms, along with protected areas in Honduras, the largest tropical rainforest in Central America and the largest pristine rainforests in the northern Amazon (Cordón & Toledo, 2008). It is surrounded by indigenous and mestizo populations. Within this reserve the Peñas Blancas Massif is located, made up of tropical and cloud forest ecosystems, where the Macizo de Peñas Blancas Center for Understanding Nature (CEN Macizo de Peñas Blancas) is established as a center for ecosystem restoration linked to the surrounding communities.

The analysis of the Center for Understanding with Nature CEN Macizo de Peñas Blancas, is a sustainable example of collective action oriented towards the search for social and environmental sustainability in Nicaragua. For 27 years, they have developed collaborative networks between various local actors, including municipalities, government institutions, civil society, farmers, and others, with the aim of restoring degraded ecosystems (Jirón *et al.*, 2024).

However, according to its representatives, its actions have not been exempted from challenges, including a lack of institutional support, the persistence of an educational model that does not foster community life, few strategies to promote resilience in the face of climate change, and a lack of balance between resource conservation and economic growth. In this regard, its representative states: “We have spent a lot of time restoring ecosystems, restoring lives, facing countless obstacles; however, we have not given up the fight” (38-year-old man, CEN representative).

This resilience and persistence have been fundamental to transforming unproductive areas into biodiverse zones with restored water sources. CEN’s ability to organize these networks and empower communities is based on the implementation of self-management strategies, natural resource protection, and biodiversity recovery, thereby enabling the improvement of local communities’ lives and, consequently, their sustainability. In this regard, its representative states: “We work with grassroots networks, interest networks, women’s networks, networks of honey beekeepers, and networks of rural experimenters to manage and protect natural resources” (38-year-old-man, CEN representative).

The promotion of sustainable practices such as water and soil management, reforestation, agroforestry agriculture, and the use of native species has facilitated the autonomous management of resources to ensure sustainability. Furthermore, CEN is oriented toward social justice, promoting equity in the distribution of natural resources and the participation of local communities in their management. Moreover, the role of women in decision-making

and the preservation of ancestral knowledge is recognized, as they play the role of guardians of ancestral knowledge and are responsible for food sovereignty, thus having a voice in decisions, policies, and strategies for sustainability.

From the perspective of inclusion and democratic participation, CEN promotes collaborative territorial management, involving diverse stakeholders in decision-making to ensure that all people’s voices are heard in the processes that affect their lives, resources, and territories. Its representative states that CEN’s proposal: “Is not just about healing or reviewing personal trauma, but also a call to change those conditions, or to contribute, to make an individual commitment, to change some of those social conditions” (38-year-old-man, CEN representative).

Therefore, CEN’s actions focus on ecological restoration and the transformation of social structures that perpetuate injustice and exclusion. These considerations demonstrate that CEN, as an example of collective action, promotes territorial sustainability from a holistic perspective, involving people and ecosystems, harmonizing their relationships, and orienting its vision toward “doing this to live and resist with joy” (38-year-old-man, CEN representative).

The case of CEN illustrates how a sustainable approach can be achieved from the perspective of social metabolism, demonstrating a constant and balanced interaction between society and nature. Through the process of appropriating natural resources, CEN has implemented regeneration and care practices, ensuring respectful use that follows the cycles of nature. According to its leader, the

purpose is: “to restore lives, restore the biodiversity of ecosystems, both in flora and fauna, highlighting the recovery of edible and perennial species that contribute to food sovereignty and resilience in the face of climate change” (38-year-old-man, CEN representative).

This proposal is based on cyclical resource management within a sustainable agricultural framework that allows for the efficient flow of vital elements, such as water, which is essential for human communities and the ecosystem. Communities manage water use in a balanced manner, ensuring that this resource reaches all sectors. Furthermore, CEN promotes the cultivation of resilient species such as bamboo and pitaya, which revitalize degraded areas, representing a non-extractive, low-impact production model. They state: “Our approach to agroecology promotes species such as bamboo and pitaya, which not only revitalize degraded areas but also represent a non-extractive production model” (38-year-old-man, CEN representative).

Regarding transformation, CEN works to regenerate degraded ecosystems and convert them into productive and healthy areas, utilizing reforestation with native species and agroforestry practices. This process allows for the sustainable use of forest resources, such as bamboo, with added value. According to its leader: “We entered the entire bamboo value chain because there was an opportunity to develop it... we use it to make beds and furniture, and we plant it massively” (Male, 38, CEN representative).

The circulation of resources in CEN is reflected in the responsible and equitable use of natural resources within local communities, respecting the

stability of the ecosystem and ensuring community survival. Water management is central to this phase, supported by community networks that ensure its use. As its leader explains, “they have collaborated with government institutions and the drinking water and sanitation committees to ensure effective water circulation” (38-year-old-man, CEN representative).

CEN promotes ecosystem regeneration through proper waste management, which includes sustainable technologies and composting, transforming waste into nutrients that enrich the soil and close nutrient cycles. They express it this way: “We have developed different ecosystem restoration or rehabilitation techniques, promoting the interaction between the necessary elements for the restoration of biodiversity” (38-year-old-man, CEN representative).

This comprehensive approach at CEN represents a vision of sustainability where human and natural systems are integrated in a dynamic equilibrium, reflecting how this type of Social Metabolism can contribute to an economic model that respects natural cycles and promotes ecological and community resilience.

From this perspective, access to resources is one of CEN’s core priorities. To this end, its work has focused on ensuring that local communities have sustainable access to water resources, especially in degraded areas, through conservation projects that promote agricultural practices that conserve soil and water, enabling communities to continue producing without compromising the regenerative capacity of the environment. In this regard, they state: “We have spent a lot of time restoring the

biodiversity of ecosystems, work that has not only improved access to resources but has also revitalized local ecosystems” (38-year-old-man, CEN representative).

Another key aspect promoted by CEN is social cohesion, through the creation and consolidation of networks that bring together not only communities but also universities, non-governmental organizations, and other key stakeholders involved in the protection of strategic areas, such as Macizo de Peñas Blancas. This social cohesion generates a sense of shared responsibility among the different stakeholders, ensuring that: “we all work together toward common sustainability goals. Visible examples include the drinking water and sanitation committees, which strengthen ties between communities and institutions to ensure sustainable water management” (38-year-old-man, CEN representative).

Community participation is a central pillar of CEN’s work, as communities are not seen as passive recipients of the benefits of conservation projects, but as active stakeholders in decision-making, the implementation of reforestation initiatives, and the protection of water sources. This participation is essential for promoting community empowerment, as its leader describes: “We have developed various ecosystem restoration or rehabilitation techniques, with the aim of promoting the active participation of local stakeholders in environmental regeneration” (38-year-old-man, CEN representative).

The analysis of the actions of CEN from the perspective of resilience and adaptation shows that it has significantly contributed to community resilience in the face of climate change-related events (droughts, floods, among others). Particularly, the

construction of community networks, has enabled effective responses to adverse climate impacts, strengthening local capacities to mitigate and adapt to them. In this regard, as mentioned: “CEN directly contributes to strengthening communities’ response capacity to environmental crises, such as climate variability and resource degradation” (38-year-old-man, CEN representative).

It is essential to analyze the importance of ancestral knowledge and its transmission in the management of CEN, demonstrating that throughout its history, CEN has recognized and valued ancestral knowledge related to water management and biodiversity preservation, which is essential for sustainable territorial management. This not only guarantees the preservation of this knowledge but also its transmission from generation to generation. In this regard, they state that: “To rescue ancestral knowledge, it is necessary to link it to science and current scientific discoveries, a situation that constitutes one of the most significant challenges today” (38-year-old-man, CEN representative).

Traditional practices are unique to indigenous and rural communities, enabling harmonious coexistence with the natural environment and offering viable solutions to address current environmental challenges. From this perspective, “ancestral practices are valuable forms of knowledge that will not be lost but will remain alive and active in future generations if all territorial stakeholders value and transmit them” (38-year-old-man, representative of the National Council of Indigenous Peoples).

4.3. Comparative analysis of the two local experiences

The analysis of the two case studies, from the perspective of collective action, shows that both organizations are well-established and that collective participation in decision-making has been a central element in their development. However, they present important differences in their internal structure and organization. On the one hand, APA Azuay presents itself as a formally and autonomously structured entity, while CEN is basically a collaborative entity integrated into external intervention. These organizational structures reflect, for example, how APA Azuay promotes internal cohesion, unlike CEN, which is more sectoral and multisectoral, as it highlights the different areas through which participatory territorial management can be channeled.

From the perspective of social metabolism, both cases speak to the sustainable management of local resources. On the one hand, APA Azuay focuses on agricultural self-management and the maintenance of native seeds. Meanwhile, CEN prioritizes the restoration of the area along with the resilient species it introduces, thus promoting food sovereignty and ecological recovery. Additionally, APA Azuay expands the value chain through the production of chemical-free foods. On the other hand, CEN incorporates the use of bamboo and other natural materials in the production of local consumer goods. This economic activity not only generates income for the community but also represents a more environmentally sustainable practice, as it utilizes renewable resources with a low ecological impact.

APA Azuay focuses on the direct marketing of fresh produce, which in turn helps boost the local economy. CEN, on the other hand, works for equitable access to water, one of the most important resources in its area. Furthermore, both manage waste sustainably: APA Azuay focuses on composting agricultural waste, while CEN focuses on soil regeneration techniques that promote natural cycles and, thereby, strengthen the relationship between the community and the environment.

In the area of territorial sustainability, APA Azuay in Ecuador and CEN in Nicaragua champion equity and social justice from different perspectives. APA Azuay focuses on creating local marketing networks that directly connect producers and consumers, strengthening community economies and promoting access to organic products. This approach prioritizes social justice for its members and fair trade in local markets. CEN, on the other hand, adopts a more inclusive perspective and integrates various sectors in the management of water and other resources. This ensures a broad and fair distribution of benefits, supported by a collaborative network.

In terms of social cohesion and participation, both projects strengthened community identity. APA Azuay is built on strong internal cohesion, uniting its members around the principles of agroecology and environmental respect. CEN also strengthens cohesion by forming alliances with universities, NGOs, and local actors to create an inter-institutional network focused on sustainable development. Regarding community resilience and adaptive capacity, both projects prepare communities to face environmental and climate challenges. APA Azuay

is committed to achieving food self-sufficiency through green technologies, thereby reducing the need for external resources. CEN, for its part, promotes joint adaptation by integrating traditional knowledge and collective practices (Table 1).

4.4. A proposal for Territorial Sustainability: Collective Action in Social Metabolism

Collective action plays a crucial role in territorial sustainability, enabling us to resist hegemonic dynamics and create sustainable social alternatives (De la Cuadra, 2017; Mardones & Zunino, 2019; Díaz Orueta, 2023; Hincapié, 2023). Consequently, it has a significant impact on integrating the different dimensions of the territory among the various actors involved.

Collective action is fundamental to territorial sustainability, as it promotes active and collaborative participation, empowering communities to make decisions that directly affect their environment and ensuring that territorial initiatives reflect their needs and interests. Thus, territorial sustainability is expressed through:

The strategic coordination of different actors, particularly academia, the productive sector, grassroots organizations, and local government. Interaction among actors strengthens trust and collective synergy as a foundation for generating effective responses to issues of public interest” (Marín González & Carrera, 2023, p. 188).

Therefore, collective action enables equitable and efficient management of natural resources and

strengthens social cohesion and promotes equity, which are fundamental aspects of sustainability (Cordón & Toledo, 2008). Furthermore, it acts as a catalyst in the reconfiguration of social metabolism, guiding processes toward equitable and resilient territorial sustainability. These dynamic highlights the interconnectedness between social, ecological, and territorial processes and underscores the central role of community participation in building sustainable futures.

From this perspective, an integrative approach articulates the concepts of collective action and social metabolism for territorial sustainability. This proposal posits that territorial sustainability cannot be understood solely as an environmental objective, but as a multidimensional process that interdependently incorporates the social, economic, and cultural aspects of the territory.

In this framework, collective action is presented as an essential driver in the reconfiguration of social metabolism, understood as the set of processes through which a society appropriates, transforms, distributes, consumes, and excretes resources within a given ecosystem, which possesses a biocapacity, understood as the quantity and quality of resources or common goods of the territory offered to social dynamics, and carrying capacity, understood in turn as the ecosystem’s ability to purify the waste produced by the activity of its population (Wackernagel, 1994).

This dynamic is key to understanding the relationship between social practices and their natural environment. Collective action guides a social metabolism of resource management toward more

TABLE 1 – Comparative table between sustainable cases

Axis	Dimension	APA Azuay	CEN
Collective action	Organizational structure	Formal and autonomous	Integrated with external intervention
	Participation and cohesion	Strong participation and internal cohesion	Multisectoral and collaborative participation
Social metabolism	Appropriation	Agricultural self-management and conservation of native seeds	Ecological restoration with resilient species and food sovereignty
	Transformation	Chemical-free food production	Production of goods with bamboo and sustainable local materials
	Circulation	Dynamizing the local economy through direct sales	Introducing an environmentally sustainable economic activity
	Consumption	Subsistence and surpluses are marketed	Consumption focused on the use of renewable materials such as bamboo, trade
Territorial sustainability	Waste	Composting agricultural waste for fertilization	Soil regeneration that supports natural cycles
	Social Justice and Equity	Focus on equity and fair access to local markets	Inclusive perspective with broad benefit distribution
	Networks and Local Marketing	Local marketing networks that connect producers and consumers	Multisectoral management that facilitates equity in access to resources
	Social Cohesion and Community Identity	Community identity focused on agroecology and environmental respect	Strengthens cohesion through inter-institutional networks
	Resilience and Community adaptation	Promotes food self-sufficiency through green technologies	Adaptation with traditional and collective practices for resilience

SOURCE: Interviews, workshops, focus groups, literature review with members of APA Azuay and CEN (2024). Prepared by: Authors (2024).

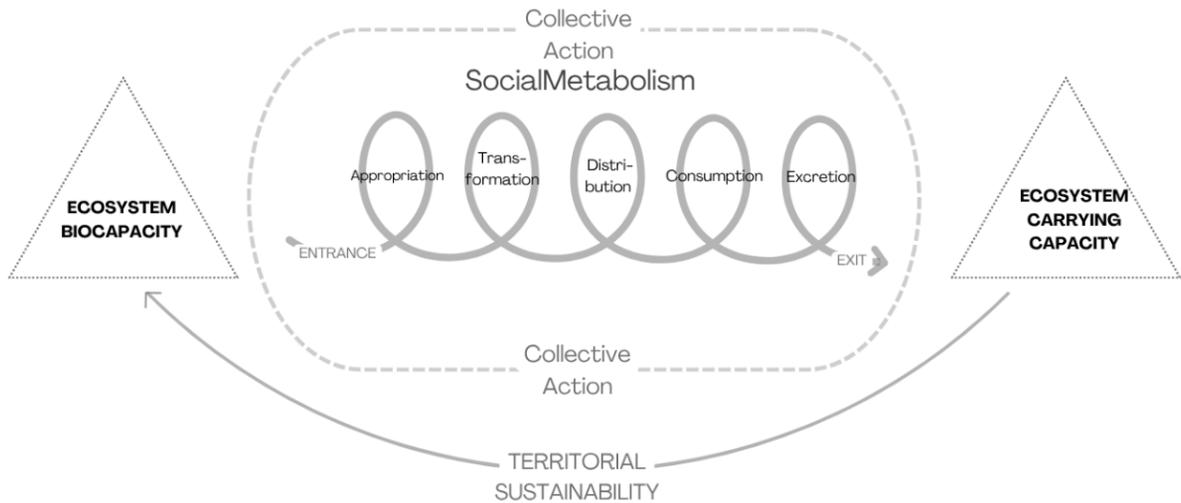


FIGURE 1 – *Collective Action and Social Metabolism as Strategies for Territorial Sustainability*
 SOURCE: Cordon & Toledo (2013). Prepared by: Authors (2024)

sustainable forms, adapted to ecological, social, and cultural conditions.

By transforming social metabolism, collective action directly contributes to strengthening equity, social justice, cohesion, and community empowerment, fundamental elements for building resilient and sustainable territories. Figure 1 represents the interdependence between the dynamics of social metabolism and collective action, as a connecting pathway for achieving territorial sustainability.

Some local experiences contribute to processes of social transformation through collective action, promoting forms of sustainability rooted in the recovery of local knowledge and wisdom, as well as in

the worldviews of the indigenous peoples in whose territories they operate. These experiences represent practices of good territorial living, in contrast to the consumerist lifestyle. In the words of Pope Francis (2015, p. 20), they seek to resist “the throwaway culture, which affects both excluded human beings and the things that quickly become trash”.

However, their sustainability depends on their capacity to adapt, resist, and transform without reproducing the prevailing extractivist logics. Specifically, in the case of agroecology, in the words of Altieri and Nicholls (2017), They assert that agroecology is an agricultural technique, but it is also a political strategy aimed at generating autonomy

in the face of the predominance of agro-industrial systems on a global scale. In this sense, in scenarios of systemic crisis, local sustainable experiences can function as temporary nodes of resistance, resilience, and restitution, but their continuity requires the construction of regional alliances, the circulation of emancipatory knowledge, and a structural transformation that transcends the local sphere to impact broader scales.

5. Final remarks

The central objective of this research was to examine how the relationship between collective action and social metabolism contributes to the formation of sustainable local territorial experiences. Based on the analysis of the analyzed cases in Ecuador and Nicaragua, the results show that collective participation in decision-making constitutes a central axis for social metabolism through the implementation of agricultural self-management actions, the maintenance of native seeds, agroecological production, and the production of local consumer goods. This situation allows them to confront social vulnerability, biodiversity loss, and environmental pollution that limit the sustainability of territories (Melucci, 1991; Díaz Orueta, 2023). In line with this premise, Veas (2022) argues that the transformative potential of collective action generates changes in the way a resource is appropriated or influences the population's consumption habits. Furthermore, collective action is presented as a concrete fact of social organization, while social metabolism turns out to be a process towards sustainability, driven by collective action.

Both studied cases promote equity and social justice by strengthening community identity and social cohesion, promoting collective practices, community resilience, agroecological principles, and community economies that directly connect producers and consumers among their members. These results are consistent with the postulates of Acosta (2015, p. 315), who argues that “building a supportive economic system, sustained on community foundations and guided by reciprocity, and subordinated to the limits imposed by nature”, guarantees territorial sustainability. The author also affirms that economic processes must be ensured to respect the ecological cycle and to be sustained over time without the need for external assistance.

Based on the research results, it is concluded that a formal, autonomous, and integrated structure – with strong multisectoral participation and social cohesion, self-managed resource appropriation and ecological restoration, chemical-free food processing and sustainable crafts, subsistence consumption and surplus socialization, as well as composting and waste management – along with an inclusive perspective of social justice – can demonstrate that collective action is linked to a social metabolism that promotes territorial sustainability.

Territorial sustainability, among other aspects, is based on a functioning social metabolism, where energy enters the system, is transformed, consumed, distributed, and waste is recycled, as opposed to an industrial social metabolism that captures energy, transforms it, consumes it, and waste degrades life on the planet. A social metabolism can be sustainable when it sustains life through collective action. This sustainable social metabolism develops within

a specific biogeophysical-social space, which promotes territorial sustainability, as Francisco (2015, p. 20) expresses:

We struggle to recognize that ecosystems function exemplarily: Plants synthesize nutrients that feed herbivores; these, in turn, feed carnivores, which provide significant amounts of organic waste, which gives rise to a new generation of plants. In contrast, the industrial system, at the end of the production and consumption cycle, has not developed the capacity to absorb and reuse waste and residues.

The analyzed experiences emerge as social movements rooted in social cohesion and community identity, centered on agroecology and the understanding of humankind and nature. They establish local and regional networks to achieve resilient community adaptation through ecological technologies and the recovery of ancestral knowledge, promoting social justice, and protecting nature. Countless experiences remain to be explored, where collective action and social metabolism promote territorial sustainability; sharing them is a challenge for scaling this sustainability to the world.

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