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The Metabolic Rift in Radical Geography: Massimo Quaini and the Territoriality of the Ecological Crisis

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Correspondence: Pasquale Pennacchio (pasquale.pennacchio@unina.it)**Received:** 8 July 2025 | **Revised:** 8 March 2026 | **Accepted:** 12 March 2026**Keywords:** historical materialism | Massimo Quaini | metabolic deterritorialization | metabolic rift | radical geography

ABSTRACT

This article relocates Marx's theory of the metabolic rift within a broader geographical genealogy, recovering Massimo Quaini's contribution and showing how his work anticipates; in territorial terms, several theoretical components were later systematized by Foster. Drawing on historical–geographical materialism, the manuscript conceives the metabolic rift as a process of territorial disarticulation of social reproduction, produced by the subsumption of territory under the logic of value and manifested in the structural separation between producers and the inorganic conditions of their existence. Building on this framework, the article develops a critique of relational ontologies in world ecology and of eco-territorialist perspectives, highlighting both their limits and their potential for understanding the ecological contradictions of capitalism. The concept of metabolic deterritorialization is introduced to describe the processes through which the socio-natural metabolism is reorganized, at the territorial scale, into spatial forms functional to capitalist accumulation.

1 | Introduction

In this article, I examine the geographical premises of the metabolic rift approach (Foster 1999; Quaini 1982; Saito 2017) to argue that, although spatiality has always been central to its development—particularly through the analysis of the city–countryside divide—its territorial articulation has remained relatively under-theorized. By territorial articulation, I do not mean spatial differentiation as such, but rather the historically sedimented configuration of socio-natural relations through which labor, property regimes, and the ecological conditions of reproduction are materially organized. Recovering this dimension allows us to reposition the metabolic rift within a specifically geographical genealogy and to clarify its implications for processes of territorial transformation. This approach can be useful for addressing eco-territorial contradictions in geographical research for several reasons: (1) it allows for the ontological positioning of the relationship between society and nature as a foundational axis of geographical investigation; (2) it enables the identification of the capitalist mode of production as

the original matrix of rupture in the relationship with the inorganic conditions of human existence, where the rift emerges as a nodal geographical expression of the law of value; (3) it makes it possible to conceptualize the territory as an ecosystemic complex of metabolic relations embedded in the processes of social reproduction and in the historicization of geographical materiality, thus, articulating the spatial analysis of the rift (Saito 2020) also at the territorial scale; (4) it aims to lay the conceptual foundations for exploring a Marxist theory of eco-territorial transformation, one that goes beyond empirical scales and is instead rooted in the historical contradictions of the capitalist mode of production and in the specific forms through which these contradictions become territorialized.

In doing this work, I started from a few assumptions:

I argue that the geographical implications of Marx's theory of the metabolic rift had already been analyzed by the Italian geographer Massimo Quaini,¹ albeit without a formal and semantic definition, in his 1974 essay *Marxismo e Geografia*, translated into English in

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1982, which contains a substantial theoretical core attributable to the Marxian framework that later inspired this conceptualization in John Bellamy Foster. It can be said that *Geography and Marxism* (Quaini 1982) anticipates and makes geographically operational some of the core elements of Marx's theory of socio-natural mediation, which Foster—and subsequently the broader school of metabolic-rift theorists—would later systematize. This proximity concerns above all the critique of the city-country divide, which in Quaini takes on a specific territorial dimension: unlike metaphysical conceptions, he situates territory within the categories of class conflict, in relation to the progressive expropriation of the producer from his environment of work (the land, the territory) and to the consequent struggle for the socialist management of territory and resources (Quaini 1982, 3). According to Quaini, in geographical terms, this can be expressed as the progressive dissociation of humans from their territory as a result of the transformation from use value to exchange value (Quaini 1982, 57). Moreover, while class struggle—and the formation of an ecological civilization (Foster 2022)—cannot be confined within a merely territorial dimension, it nevertheless assumes specific territorial connotations in relation to capitalist forms of organization: humans encounter territory not as isolated individuals but as members of a community (Quaini 1982, 60).

In this sense, I believe that some of the criticisms directed at the theory of the metabolic rift would find a well-articulated and philologically grounded response in Massimo Quaini's thoroughly ecological elaboration, a contribution that has remained largely overlooked within the eco-Marxist debate, especially among Marxist-inspired geographers.

I explore the territory within the framework of historical materialism, taking it as the structuring space of social relations and the concrete field of original accumulation, in which the transition from the centrality of use value to full subordination to exchange value takes place. This framework allows me to reposition the theory of metabolic rupture in the field, identifying lines of research that enable it to be placed in a political position within the contemporary ecological framework, that is, transformative at the territorial level.

In light of the theory of the metabolic rift, I propose a problematization of the territorialist approach (Magnaghi 2009, 2018), despite its maturation within an extremely prolific transdisciplinary context—to which Italian geography has contributed since its origins, in particular through the work of Quaini. In its most recent eco-territorialist articulation (Magnaghi and Marzocca 2023), this approach tends in fact to configure itself as a conceptual field characterized by a high degree of abstraction, in which the reference to territorial self-referentiality risks politicizing the principle of self-sufficiency while detaching it from the material contradictions that define socio-ecological reproduction.

2 | *The Metabolic Rift at the Origins of Geographical Thought: The Contribution of Massimo Quaini*

The theory of the metabolic rift entered the eco-Marxist debate in the late 1990s, thanks to the contributions of John

Bellamy Foster (1999, 2000) and Paul Burkett (1999, 2003). In recent years, with the growing prominence of political ecology in international debate, this theory has been revisited, employed, and critiqued across various fields. Geography, in particular, has shown a general tendency toward disinterest in the concept (Napoletano et al. 2019), with a few recent exceptions (Barua 2025; Davies 2025; Napoletano et al. 2018; Rey-Araújo 2024); in other instances, starting from an epistemological hybridism, it has raised doubts about the theoretical coherence and interpretive capacity of the concept, criticizing its claim to establish a dualistic autonomy of nature (Castree 2002, 2004, 2015, 2016).

In this scenario, this work aims to recover the geographical thinking implicit in this theory and highlight its transformative link with radical geography, where historical materialism is not limited to the dialectic of social relations but is based on the physical constitution of human beings and their inseparable relationship with nature (Harvey 1996, 1998; Santos 1977). Borrowing the words of geographer Massimo Quaini in *Geography and Marxism* (1982), we can say that:

It would be foolish to claim that the founders of historical materialism were the forerunners of geography [...] but in Marxism just as there is a theory of history and analysis of society, there is also a geography, provided that by geography we primarily mean, with Gambi, the history of the cognitive conquest and regional development of the earth, as a function of how society has come to be organized. [...] there are in Marxism not only innumerable pointers to research but also a theory of geography and of the limits of geographical factors and conditions.

(Quaini 1982, 41–42)

This leads us to consider human history and natural history within a common dialectical framework grounded in the unity of historical-material processes. Quaini's historiographical approach, in continuity with that of Lucio Gambi (1973), translates into geographical terms the principle according to which spatial processes are historical forms of the society-nature relationship. It is from this perspective that the connection can be grasped with Engels's reflection in the *Dialectics of Nature*, where, drawing on Kant's analysis of the formation of the solar system, Engels (1971) identifies temporality and transformation as constitutive principles of natural reality. In Quaini, this materialist horizon becomes a method for reading geographical processes as historical processes that is as concrete forms through which society organizes its relationship with nature:

So, in order to understand the full significance of historical materialism, both at the general scientific level, and, still more, in relation to geography, we need to hold firmly to Marx's conception of nature and not allow ourselves to be impressed by terminology that is not always consistent [...] But if Marx recognized "the primacy of external nature" he hastened nevertheless to say that this distinction between a pre-social

nature and nature mediated by society “has meaning only in so far as man is considered to be distinct from nature” [...]

(Quaini 1982, 34–35)

With his critique of political economy, Marx expands this foundation by translating the radical naturalism of the *Manuscripts* into a historical and dialectical theory of socio-natural metabolism, in which labor is conceived not only as a manifestation of human essence but also as a material process of mediation between humans and nature, an *organic exchange* (*Stoffwechsel*) that structures and transforms itself in relation to the historical forms of production relations (Marx 1974, 211). This concept, borrowed from the natural sciences of the time, in particular from the works of his contemporary Jacob Moleschott, led him to develop a dialectical theory of the relationship between society and nature, in which the reproduction of material life depends both on natural cycles and on the social forms in which they are inscribed (Foster and Burkett 2000).

With capitalism, this metabolism is profoundly altered. Capital does not merely use natural resources as the material basis of production, but organizes them according to abstract valorization (Burkett 1999; Foster 2000). The result is a structural dissociation between natural cycles and the production process, which Marx describes with his analysis of the *separation of town and country*, strictly geographical, and with the *crisis of soil fertility*. The resulting imbalance, the *rift in the organic renewal prescribed by natural laws*, which will later be systematized as the *metabolic rift*, is an ecological crack that manifests itself in the decoupling of agricultural production and soil regeneration: the nutrients taken from the land do not return to it, but accumulate in cities in the form of waste, pollution, loss of fertility and degradation (Burkett 1999, 2006; Foster 1999, 2000; Quaini 1982; Saito 2017).

The metabolic rift takes on the character of a systemic laceration, in which capital accumulation is achieved through the exploitation of sources of wealth: land and labor. This process, which Marx analyses in its historical concreteness (Quaini 1982), is an ontologically connoted dynamic: capital behaves as a force that consumes both nature and human beings, and in which its true limit is capital itself, that is, the production of profit for profit's sake (Marx 1974), making it intrinsically anti-ecological.

This concept found a foundation in eco-Marxism in the 1990s, taking root in the thinking of a long tradition of thinkers thanks to contributions from environmental sociology. In his essay “Marx's Theory of Metabolic Rift”, John Bellamy Foster (1999) introduces the analytical category of the metabolic rift as the basis of the Marxist theory of ecological crisis, attributing its epistemological paternity to Marx himself, while also discussing the exegetical and historiographical context from which it emerges. This aspect represents an interpretative knot, since the theoretical genealogy of the metabolic rift—before its semantic systematization—had already been investigated by a number of authors; among these, a pioneering role within geography was played by the geographer Massimo Quaini in the 1970s who, in an attempt to move human geography in Italy beyond the limits

imposed by the necessary overcoming of the determinism–possibilism dichotomy² (Quaini 1974, 1975, 1978), reconfigured the environmental question as the epistemological pivot of historical materialism in human geography, focusing almost the entire treatise on the “ecological questions” in Marx, linking them to the historical materialist method.

If it is true that the metabolic rift, as conceptually systematized by John Bellamy Foster and others (Foster 1999, 2000; Foster et al. 2010), marked a paradigm shift in the development of a Marxist theory of ecological crisis, it is equally true that its geographical implications had been clearly analyzed by Quaini: the rift between town and country as the spatial keystone of capitalist alienation, the centrality of labor as a territorial mediation between society and nature, attention to the historical processes of territorialization of the productive forces, the formation of urban agglomerations, and the systemic separation between living labor and the objective conditions of reproduction. Starting from these elements, it is possible to read in Quaini (1982) a fully fledged ecological–territorial analysis. His method, grounded in historical materialism, reconstructs the formation of urban agglomerations, the systemic separation between living labor and the objective conditions of life, and, more generally, the ways in which capital ecologically reorganizes space. From this perspective, geography must historically investigate the forms that capital assumes and the consequences that these forms produce for the socio-ecological metabolism. It is in the sense that Quaini's reflection anticipates the eco-Marxist reading of the metabolic rift.

Quaini offers a vision of the organic exchange elaborated by Marx as a problematic horizon—and not as a static category, as described by some contemporary authors (see Cox 2015; Engel-Di Mauro 2014; Schneider and McMichael 2010)—within which the dialectical relationship between nature, space and social reproduction is articulated. His theoretical framework is based on the assumption that, in Marx's *Capital*, there is no essential node that does not carry with it, in a more or less explicit form, the theme of the relationship between society and nature, “that is to say the theme that should be fundamental to the scientific edifice of human geography” (Quaini 1982, 52).

Although Foster does not devote significant analytical space to the geographical questions raised by Quaini—whose work remains part of a genealogy centered on the relationship between historical materialism and geography—it is nevertheless possible to hypothesize that Quaini's elaboration served, even indirectly, as a theoretical precursor to the reflections developed by the main proponent of the metabolic rift. Moreover, this would be consistent with the idea, supported by Foster (1999, 2000) himself and by Kohei Saito (2017), that the metabolic-rift perspective constitutes a fully ecological critique rooted in Marx.

Foster (1999, 391, 2000, 9) directly cites Quaini, recalling the well-known formulation according to which Marx “denounced the spoliation of nature before a modern bourgeois ecological conscience was born” (Quaini 1982, 136). Beyond this citation, the points of contact concern the way in which both authors reconstruct the relationship between historical materialism, the natural sciences, and ecology. On the one hand, Quaini shows

that, in Marx's methodological writings, a radical critique is developed of the way in which bourgeois science begins from categories that appear concrete (population, space, development) only to dissolve them into abstractions, whereas the Marxian method proceeds from the simple to the complex, from the abstract to the concrete, reconstructing the historical totality that binds society, nature, and territory together (Quaini 1982, 9–10). Foster takes up this same issue when, against economic readings of Marx, he insists on the need to read the critique of political economy as a materialist theory of nature and history, in which the natural dimension is an internal component of the process of social production and reproduction (Foster 2000, 19–20).

This convergence becomes even more pronounced with regard to the Malthusian and Darwinian question. Quaini shows very clearly how Darwinism, insofar as it elevates the struggle for existence to the status of a universal law of species, merely projects onto nature the historically determined categories of bourgeois society: division of labor, competition, the opening of new markets, and the generalized struggle among individuals and groups. He further adds that this operation, which in Ratzelian geographers becomes the claim to provide a scientific foundation for geography by reducing human beings to the laws governing the distribution of all organic life on Earth, has the ideological function of naturalizing the social relations specific to capitalism (Quaini 1982, 9–10).

Foster undertakes an analogous theoretical dissection: on the one hand, he meticulously reconstructs Darwin's debt to Malthus and the Malthusian inflection of the notion of "struggle for existence" (Foster 2000, 185–187); on the other hand, following Engels, he criticizes the social-Darwinist uses that extrapolate this image of nature in order to project it back onto society, thereby transforming capitalist relations into eternal laws of human coexistence (Foster 2000, 206–207). Quaini shows how Marx, in criticizing Malthus, rejects the idea of an abstract law of population and insists that each mode of production has its own specific law of population, historically determined and inseparable from the development of the productive forces (Quaini 1982, 40–41); Foster takes up this distinction when he shows that Marx's principal target is not the empirical observation of demographic growth, but rather its ideological use to legitimize poverty and environmental degradation as *natural effects* of overpopulation, instead of understanding them as outcomes of the regime of property and the capitalist mode of production (Foster 2000, 92–94, 185–187).

Another aspect certainly concerns the way in which Quaini and Foster, drawing on Marx, interpret the metabolic relation between nature and society. In the section on Capitalism and Ecological Contradictions, Quaini emphasizes that capitalist accumulation, by concentrating population and productive activities in large urban centers, breaks the organic circulation between the city and the agricultural soil, interrupting the return of nutrients to the land and establishing a destructive relationship with the natural conditions of production (Quaini 1982, 123–124, 128).

It is in this context that Quaini extensively cites the pages of *Capital* on the circulation of matter between humans and the

soil, and on the necessity that any stable society consider the land as common property (Quaini 1982, 122–143, especially 128–130), thereby anticipating what Foster would later conceptualize as the metabolic rift. Similarly, Foster shows how the structural separation between town and country, the draining of nutrients from the soil, the importation of guano and bones from peripheral countries, and the nineteenth-century agricultural crisis constitute, for Marx, the paradigmatic case of a rupture in the socio-natural metabolism produced by the capitalist-mercantile forms of organizing production (Foster 2000, 141–163, especially 158–159). The idea—central to Marx's *Ecology*—that capitalism tends simultaneously to destroy labor-power and soil fertility, that is, that the logic of valorization dissolves the natural conditions of social reproduction, is already fully present in Quaini's reading of Marx as a critic of a development of the productive forces that irreversibly consumes the territorial basis upon which it rests, of the civilizing power of capital that breaks down all obstacles that impede its expansion (Quaini 1982, 126).

To revisit this tradition today does not mean seeking alternative paths to the achievements of contemporary Marxist ecology, but rather reinterpreting them through the lens of a geographical tradition that was capable of thinking the spatiality of ecological contradictions in a radical way (Quaini 1982). In this regard, Foster's (2000, 2012) contribution has had the merit of restoring full centrality to the notion of social metabolism. Similarly, Paul Burkett (1999, 2006) has carried out essential work to firmly connect the critique of political economy—and the categories of value, labor, and wealth—to the ecological crisis of capitalism. This does not mean reading the crisis of capitalism as an ecological system (Moore 2011, 2015), but rather the ecological crisis within the capitalist forms of social reproduction. Within this broader research context, the aim is above all to offer a hypothesis of reconnection with lines of inquiry within geography, recovering the insights that Quaini had already indicated.

3 | Ontology of Nature: Towards a Critique in Critical Geography

Focusing on the relationship between society and nature in ontological terms does not imply recourse to substantialism or to a metaphysical foundation external to the historicity of practice. What we aim to highlight instead is a perspective internal to the genesis of social forms, in which the "human" and "natural" spheres are defined by mutual differentiation—and this is certainly a field of contemporary debate for political ecology, but even more so for geography—within the same historical-material field (Engels 1971). In this sense, this section seeks to show how the ontological core of the society–nature relation constitutes the basis of the Marxian critique associated with the metabolic rift, working from within the geographical debate and intersecting the geographical questions of the metabolic rift raised by Quaini.

The idea of nature as an originally constitutive moment of human life is inseparable from Marxian theory. Darwin's *On the Origin of Species* strongly stimulated Marx and Engels' thinking, as it was considered "the historical-natural foundation" of their conception. For Levins (2008), *Capital* represented the first

investigation of a complex object as a system, as it explored both economic and ecological foundations, an approach he himself would later contribute to, for example, through his analysis of feedback loops. It was thus not only the foundation of historical materialism but also of *dialectical naturalism*, a perspective closely associated with Engels' contribution (Foster and Clark 2023).

The relationship between society and nature has been at the heart of geography since the emergence of modern geography. Alexander von Humboldt's reflections already sought to capture the complex and creative interaction between nature and human imagination (Farinelli 2018). Between the 19th and 20th centuries, geography was structured around an epistemological framework that was entirely contingent on the positivist and functionalist horizon of its time, having as its object "the distribution of physical, biological and anthropogenic phenomena across the Earth's surface: the causes of this distribution, the local relationships between these phenomena" (Gribaudi 1930, 7, translated by the author).

This geography exhibited a homogeneous methodological orientation: a form of knowledge grounded in the strict separation between subject and object (Dansero and Dematteis 2023, 51–52), between humanity and nature, thereby reproducing within the scientific order the dominance of reason. It is on this basis that Lucio Gambi (1973) was able to define such geography as an ecological science, in the most reductive sense of the term, advocating instead for the use of a historiographical method capable of interrogating not things *in* themselves, but the meanings historically produced by communities in relation to those places and objects.

Pioneering this critical awareness were figures such as Elisée Reclus and Eric Dardel, who were able to grasp the limitations of the objectifying paradigm and point the way toward overcoming the epistemological rift between nature and culture (Dansero and Dematteis 2023). Beginning in the 1970s, this relationship was redefined and relocated within new epistemological frameworks aimed at overcoming the dualism between nature and society—though not without tensions, particularly in light of the growing influence of existentialist, constructivist, and, not least, postmodernist currents, which were sharply criticized by Anglo-American radical geography (Harvey 1989; Smith 1999; Smith and O'Keefe 1980).

In this regard, the scientific weight of Quaini's reflections resurfaces, as he asserted that Marxism already contained all the necessary elements for "a radical criticism of a view of the relationships between man and nature" (Quaini 1982, 8). In this sense, the thematization of the "dualist" relationship between humanity and nature had already been made explicit within the context of their co-belonging in the dialectical movement of praxis. Thus, "the important question of the relations between human beings and nature [...] vanishes into nothing if one realizes that the unity of man with nature has always existed [...], and in each era it has existed in a different way" (Marx 1977, 24–25, translated by the author).

The Marxian concept of nature is identified with reality as a whole. In *The German Ideology*, Marx and Engels (1977)

highlight how the distinction between pre-social nature and socially mediated nature—what Neil Smith (1984, 2008) would later call the *production of nature*—loses its meaning, since humanity cannot be conceived as something separate from nature. Indeed, Quaini (1982) emphasizes that Marx does not situate nature within a purely ontological dimension, in an abstract or metaphysical sense, but rather as a moment of human praxis in which the history of nature and the history of humanity mutually condition one another:

Man is directly a natural being. As a natural being and as a living natural being he is on the one hand furnished with *natural powers of life*—he is an active natural being. These forces exist in him as tendencies and abilities—as *impulses*. On the other hand, as a natural, corporeal, sensuous, objective being he is a suffering, conditioned and limited creature, like animals and plants.

(Marx 1978, 115)

Nature in Marx never appears as a separate entity—that is, as an abstract condition—but rather as an internal instance within the historical morphogenesis of social formations. It is embedded in the material concatenation of social processes, according to a logic in which the history of nature and the history of humanity intersect and mutually imply one another.

As Quaini (1982, 59–61) clarifies, the transition from "natural society" to "historical society" represents the ontological turning point of Marx's reflection. Nature is no longer the external foundation of human life, but the very material of its historicity. Only in praxis does the human being become nature conscious of itself, transforming its material conditions and itself.

In this context, Alfred Schmidt's *The Concept of Nature in Marx* (1971) has undoubtedly shaped more than one academic era (and beyond) in the interpretation of the nature–society relationship in Marx. Rejecting historicist subjectivism that reduces nature to a mere product of praxis, Schmidt developed an approach grounded in the dual mediating structure of the human–nature relation. He tends to frame Marx's mature thought within a Promethean and productivist perspective, arguing that the emphasis on the development of the productive forces implies a form of domination over extra-human nature as well as over the human being, conceived as subjective nature. This interpretation—later revised in the introduction to the 1993 edition (Bergamo 2022)—has influenced the political ecology debate for decades, shaping it critically and leading numerous authors—Benton, Gorz, O'Connor, Leff, Lowy, Martinez-Alier, Ariel Salleh, among others—to develop a negative assessment of Marxist ecology (Foster 2016).

Along these trajectories emerged the well-known research perspective built around Neil Smith's (1984, 2008) paradigm of the production of nature (Castree 2000, 2002), which criticizes the Frankfurt School approach, particularly Schmidt's own earlier work, for its separation of use value from exchange value (Smith 2008, 50), and rejects dualism as a form of bourgeois false consciousness (Smith 1999). This analysis had a significant impact on radical geography due to its ability to displace the

nature–society dichotomy in favor of a constructivist reading rooted in Hegelian thought (Napoletano et al. 2019). However, it has been pointed out that this formulation tends to elide the distinction, central to Marx, between the *transformation* and the *production* of nature, thereby surpassing the dialectical specificity of the socio-natural metabolism (Burkett 1999; Saito 2017).

While for Marx every productive process entails an interaction between humanity and nature—where the latter retains an ontological autonomy not fully subsumable under the value form (Marx 1974)—in Smith’s perspective “second nature”, understood as socially produced nature structured by exchange value, does not merely transform “first nature” but progressively rearticulates it within the very logic of capitalist production. Second nature thus emerges from first nature as part of a practical process through which the entirety of nature is reorganized within the circuits of capital. In this sense, nature is no longer primarily conceived as an external condition historically transformed by capital, but as increasingly produced from within the socio-spatial relations constitutive of second nature itself (Smith 2008, 68–70). The distinction between transformation and production is thereby displaced at the semantic level, with significant implications for how the alterity and relative autonomy of extra-human nature are theoretically understood.

Moreover, elements of reflection that Quaini’s writings had already anticipated can also be found in Smith’s work, particularly regarding the geographical conditions of reproduction, especially in relation to large-scale production, which is not exclusive to capitalism (Smith 2008, 77). This analysis is rooted in the first volume of *Capital*, which Quaini commented on as follows: “the process of reproduction on a progressive scale [...] corresponds to the historical expansionary tendency of capital, which in practice sets in motion the process of accumulation by transforming part of the social surplus product into fresh capital (new means of production and new means of subsistence)” (Quaini 1982, 79). It is precisely the geographical conditions of reproduction that determine the irreversible rupture in the relationship between human beings and nature: ecological reproduction ceases to be an end in itself and becomes subordinated to abstract logics of accumulation.

While the *production of nature* paradigm tends to overlook these contradictions, the theory of the metabolic rift enables their disclosure by articulating how capital ultimately intensifies the contradiction between town and country and promotes forms of ecological regeneration that serve accumulation rather than ecological repair (Foster et al. 2010). The *metabolic rift* approach safeguards the dialectical dimension of the relationship, recognizing that although humanity is part of nature, this does not imply that nature cannot retain elements of autonomy. The attempt to erase this alterity through an ontological fusion risks obscuring the real conditions of domination and expropriation (Foster and Clark 2020), thereby also emptying the Marxian critique of its political content. As Harvey (2012) has pointed out, the universality of production in Marx does not entail the erasure of nature but rather affirms that the metabolism between humanity and the natural world constitutes an *eternal necessity*.

4 | From *Dialectics to Web With No Return?* On the Specific Logic on the Specific Object

In the debate animated by critical theories on the society–nature relationship, Jason W. Moore’s proposal stands among the most influential within contemporary political ecology, particularly among geographers. According to Saito (2023, 107–113), Harvey’s adherence to the logic of “nature production,” shared with part of radical geography, ends up obscuring the non-identity of nature and dissolving its specificity within the order of social mediation.

At the same time, it is also one of the most controversial, due to the theoretical radicalization of the socio-natural co-production paradigm. Moore (2015), founder of *world-ecology*, reformulates the core categories of historical materialism and world-systems theory (Arrighi 1998; Wallerstein 1974, 1979) through a hybrid ontology that, drawing on Latour’s (2005) relational monism and Donna Haraway’s (1987) post-humanism, seeks to overcome any distinction between nature and society, proposing their dual internality as the foundation of the historical process.

The underlying issue is that the dualism between nature and society, even when interpreted through a dialectical lens, perpetuates a Cartesian view that is incapable of grasping the integral historical co-production of what we call “nature” and “society.” In this sense, Moore also criticizes the theory of the metabolic rift, particularly in the way it is articulated by Foster, arguing that it remains anchored to an underlying dichotomy that presupposes the pre-existence of a nature external to capital, which is subsequently violated.

As an alternative, he proposes the concept of *Oikeios*, within which specific historical–ecological forms are co-produced, establishing it as the organizing principle of a relational ontology that dissolves the boundaries between human and non-human agents, extending agency to both organic and inorganic entities, which are also considered active participants in the historical process. Within this framework, Moore’s approach converges with Anglo-American geography (Castree 2002, 2004; Castree and Braun 2001), through their shared Latourian matrix rooted in Actor-Network Theory (Latour 1996, 2005). History would thus be the contingent and stratified result of the entanglement between biological changes and logics of accumulation, in which capitalism operates “through” and not simply “on” nature (Moore 2011, 2015). This operation is always mediated by power relations that, in a hegemonic sense, are articulated across different spatial and temporal scales.

Contrary to its declared intention of overcoming the Cartesian dichotomy, the relational and monistic ontology proposed by Moore through the concept of *Oikeios* risks, when viewed through the lens of dialectical materialism, falling back into a paradigm that reproduces what Marx identified as the “structure of speculative Hegelian dialectics,” which he described as a “false mobility,” referring to the mystical disguise of the unity between humanity and nature as a “mystical identity of being and thought” (Marx 1972, 205, translated by the author).

As Quaini (1982, 27–32) observed regarding speculative dialectics, the mystical structure of the Hegelian dialectic

consists in subordinating empirical concreteness to the Idea and in absorbing real multiplicity into a premature synthesis. Against this speculative logic, Marx—and, with him, Quaini's materialist geography—asserts the necessity of a “specific logic of the specific object,” in which knowledge does not precede the real but is rooted in the material processuality of history. In this way, Quaini translates Marx's critique of Hegel into an epistemologically geographical problem, in which the understanding of the historical forms of reality must begin from concrete social relations rather than from ontological abstractions.

Marx's central criticism of Hegel in *The Holy Family* is that he proceeds with his analysis not according to concrete logic, but according to the deduction of determinations from preconceived thought, which proceeds as follows. This proceeds through a sequence: hypostatization of the idea; elimination of sensible difference; return from abstraction to empirical reality; speculative renunciation of abstraction; and the mystical transfiguration of things. This mechanism takes shape in the substitution of the sensible object with an abstract entity that subordinates and reinterprets every manifestation of the former.

In Moore, the *Oikeios* performs the function of unifying abstraction, capable of reabsorbing every socio-ecological singularity into the meta-historical network of the co-production of nature and society as a “cascade of environment-making processes and relations” (Moore 2015, 174). The sensible differences and concrete articulations of historical modes of production—primarily the capitalist mode—are thus elevated to expressions or configurations of the *Oikeios*, denying the possibility of an analysis based on the specific logic of the specific object (Marx 1972). The real history of socio-natural formations disappears behind the post-structuralist universalism of the *web of life*, in which every relationship is simultaneously cause and effect, without it being possible to distinguish the historically dominant vectors, that is, the way in which the capitalist value form determines the entire field of material reproduction.

This leads to a sort of conceptual tautology: capital is nature and nature is capital, since both are co-productive expressions of the *Oikeios*, but on condition that they are no longer either nature or society. This is where the speculative short circuit lies: concrete nature, differentiated and historically determined in its contradictions, is dissolved into a reification of the idea (*Oikeios*) emptied of empirical consistency, except as the result of its own abstraction. This operation tends to evade the historicity of socio-ecological relations, renouncing the possibility of identifying the historical conditions of the ecological crisis in the forms of social reproduction. The recourse to taxonomies such as “capitalism-in-nature” or “nature-in-capitalism” (Moore 2011, 2014, 2015), therefore, does not resolve the theoretical ambiguity of a shift toward forms of idealism, in which capitalism ceases to be a specific object to be analyzed according to its own laws of motion (value, surplus value, accumulation, alienation) and becomes the totality within the indefinite cycle of living relations.

For Marx, historical materialism is grounded in the capacity to read the sensuous world as the historical product of social activity, and thus to trace its unity not in the speculative immediacy

of a unifying substance, but in the multiplicity of historical mediations. The unity between humanity and nature is never given once and for all—neither as destiny nor as ontological presupposition—but is instead produced historically according to social needs and the configuration of relations of production (Marx 1977, 24–25).

The assumption of an all-encompassing co-production risks conceptually erasing the material specificity of socio-ecological contradictions, rendering unintelligible any differential analysis of the historical causes and responsibilities of the ecological crisis. In this sense, the critiques raised by the literature on the metabolic rift deserve serious attention (Foster and Burkett 2018; Malm 2018): the dissolution of all analytical distinction between nature and society leads to an ontological flattening that undermines the understanding of processes rooted in the contradictory metabolic unity of capital and nature, where the unity of opposites unfolds. This aspect is also insightfully addressed by Harvey (2014). The risk—if we may call it that in its speculative form—is the loss of the critical potential of historical materialism, thereby disabling the possibility of identifying causal links between relations of production and ecological processes.

In other words, in an attempt to dispel any analytical distinction between society and nature, Moore's proposal constitutes a radical redefinition of the ecological paradigm, based on the rejection of all dualism. In his generalized rejection of any conceptual separation between human and non-human factors, Moore paradoxically arrives at what Mészáros (2010) would call a “flat ontology” in which any conflictual articulation between nature and society is precluded, preventing a historically situated reading of the metabolic contradictions of capital (Foster and Clark 2016).

To this must be added a reinterpretation of the concept of value which, although framed within the Marxian lexicon, tends to empty it of its historically specific social content. Moore (2015) proposes a conception of value as a general principle of evaluation rather than as the social form of abstract labor. By contrast, the theory of the metabolic rift—while rejecting all forms of Cartesian dualism—preserves the dialectical core of historical materialism, restoring to Marxian thought the capacity to discern, within historical totality, the alienated mediations between social processes and ecological dynamics (Foster and Burkett 2018) and, as already indicated by Quaini (1982), it places territory at the center of the geographical articulations of the rift.

Indeed, it is precisely against this kind of abstraction that Quaini asserts the analysis of historical and territorial specificities as a necessary condition for understanding the genesis of socio-natural formations. Each mode of production inscribes its material contradictions into the morphology of the territory. Losing this concrete perspective inevitably leads to the dissolution of the historicity of the relationship between society and nature into a meta-historical plane of undifferentiated relations.

In opposition to those readings that portray the labor theory of value as distant from the active subsumption of the natural dimension, the Marxian tradition demonstrates that the

abstraction of value is a historically determined and socially alienated form of wealth (Burkett 1999), in which the objective movement of capital conceals nature's contribution to the production process (Burkett 1999, 2004; Fraser 2014). Capitalism enacts a form of rationality that abstracts the ecological conditions of human existence, separating labor from nature and reducing wealth to abstract labor time, at immense social and environmental cost (Burkett 1999, 2006; O'Connor 1988, 1998).

A materialist approach to the contemporary ecological crisis can only be based on the dialectic of social metabolism, in which the contradictory relationship between capital and nature is historically situated and processual. This is precisely where the need for a return to dialectics based on concrete objects.

From this perspective, Quaini (1982, 70–72) anticipates a fully geographical conception of the metabolic rift, understood as a process of territorial disarticulation of the society–nature relation. Ecological crisis is the result of a distorted spatial metabolism, in which capitalist production concentrates and separates, accumulates and devastates, organizing social reproduction through the spatial form of separation, which I define here as *metabolic deterritorialization*.

5 | The Alienation of Inorganic Conditions of Existence: Metabolic Deterritorialization

Marx's reflection on social metabolism, and on the fracture that compromises its reproducibility, is rooted in direct comparison with developments in agricultural chemistry, in the context of the agricultural and scientific transformations of the first half of the 19th century, in particular with the work of Justus von Liebig (Foster 1999; Quaini 1982; Saito 2017).

Separation from inorganic conditions is both the prerequisite and the product of the logic of exchange value, which reduces the qualitative incommensurability of nature and living labor to the abstract measure of the socially necessary labor time required to produce commodities (Burkett 2006; Postone 1978).

This trend is, therefore, historically situated and characterized by different modes of appropriation and restitution of natural resources. The capitalist mode of production, in its hyper-expansive tendency toward accumulation, progressively tends to interrupt the circularity of organic renewal, transforming metabolism from a process of territorial reconstitution into a linear and, consequently, dissipative flow (Fischer-Kowalski 1998).

This is the context in which the “second agricultural revolution” began, initiated by Liebig's organic chemistry, which provided Marx with a scientific explanation of the role of nutrients—in particular nitrogen, phosphorus, and potassium—in soil fertility, and contributed to the development of a new fertilizer industry. Starting from these developments, he deepened his agronomic knowledge, from which he drew the elements to elaborate the rupture of the society–nature nexus, conceived as a direct consequence of the contradiction between the growing depopulation of the countryside and increasing urban concentration (Foster 1999, 2000; Quaini 1982; Saito 2014, 2017).

Marx's analysis of the ecological crisis is, therefore, rooted in the internal contradictions of capitalism's territorial organization. However, unlike many ecologists, Marx does not separate the contradictions of nature-territory from the contradictions of society-labor power (Quaini 1982).

The historical dynamics of the industrial revolution brought about a profound transformation of the human–nature metabolism, dissolving the organic circuits that, in previous social formations, reproduced themselves within an order regulated by natural necessity. The urban concentration of the population breaks the material balance between consumption and regeneration, hindering the return to the soil of the residues of production and consumption which, in their spontaneous circulation, constituted the basis of fertility. This densification of the city is contrasted by the emptying of the countryside, the dispersion of the rural labor force over increasingly vast and fragmented territories, and the spatial disarticulation of the material conditions of social reproduction. The effect of this dynamic is not only biophysical impoverishment but also a crisis of social reproducibility itself (Foster 1999; Quaini 1982; Saito 2017).

In this sense, metabolic rupture is a geographical process: the growing spatial separation between places of agricultural production and urban centers of consumption prevents nutrients from returning to the soil and dissolves traditional forms of territorial metabolism. In this way, capital carries out a process that I define here as *metabolic deterritorialization*, in which the valorization of resources is accompanied by a growing ecological fracture, that is, the overall breakdown of human–nature relation, resulting from an alienated system of endless capital accumulation (Foster et al. 2010), as a product of artificial divisions within humanity, which distance us from the material and natural conditions of our existence and from future generations.

By metabolic deterritorialization I refer to the historical process through which capitalist accumulation disarticulates socio-natural cycles from their territorial bases of reproduction, reorganizing them across spatial scales in ways functional to valorization. This entails three interrelated dynamics: (1) the separation of producers from their inorganic conditions of existence; (2) the displacement of material flows from the territories that sustain them; and (3) the subordination of ecological regeneration to the temporal imperatives of accumulation. In this sense, metabolic deterritorialization designates the specifically geographical form assumed by the metabolic rift under capitalism.

Marx, reading Liebig and under the influence of Moleschott, focused mainly on certain materials, in particular soil nutrients, which, from the human body, end up in sewage systems and water basins without being adequately returned to the soil itself. The waste produced by cities, particularly human and animal organic residues, is no longer reintroduced into the production cycle but accumulates in urban centers in an entropic manner, generating forms of pollution that compound the depletion of the countryside. According to Engel-Di Mauro (2014, 137), Marx's analysis of metabolism makes him a “non-dialectical thinker”, especially in terms of soil science. However, it is clear that understanding of the era of soil, biogeochemistry, and agroecology was limited (Schneidere and McMichael 2010),

together with the fact that Marx never concluded his analysis in *Capital* (Saito 2017). These aspects hindered his broader argument. Furthermore, Marx's concept of metabolism must be read within socio-ecological categories; otherwise, the very objective of this analysis is lost.

Metabolism proves to be a fundamental epistemological category for geographical thinking, as it allows us to grasp the inherent intertwining of disciplines with ecology and economics. It also allows us to establish a radical territorial thinking that considers ecological reproduction as a spatial issue, starting from the assumption that when we think of the Earth, we are actually thinking of the territory (Dematteis 1985, 98).

It is in this context that the concept of alienation of the inorganic conditions of existence takes on its full meaning: nature, as the inorganic body of humanity, is separated from the reproductive process and reconfigured as a field of extraction and dissipation; metabolic relations, which originally constitute the material unity of existence, are interrupted and reterritorialized on scales that dissolve the immediate human–territory relation, between use and exchange, between consumption and re-composition. Metabolic deterritorialization, thus conceived, cannot be reduced to the mere deconstruction of local cycles, but expresses the concrete form of ecological alienation, the historically produced separation between the reproduction of life and the material space in which it takes shape.

Since the 1970s, the theme of socio-natural metabolism has become the subject of great interest (Fischer-Kowalski 1998). In 1969, German geographer Ernst Neef explicitly referred to the metabolism between society and nature as a central problem of geography (Fischer-Kowalski 1998, 69). In the contemporary debate on the notion of social metabolism, Marina Fischer-Kowalski's work represents a theoretical and methodological turning point that allows the processes of material exchange between society and nature to be inscribed within a systemic approach based on the Material Flow Analysis (MFA), but at the same time open to a historicization of sociometabolic forms and to the distinction between historical regimes of resource appropriation (Fischer-Kowalski and Haberl 2007).

Although this approach does not explicitly criticize capitalist relations of production, in which the historical and social genesis of the relations of domination that produce them remain in the background, it offers an anchor for a materialist genealogy of metabolism. Metabolism is thus conceived as a dissipative structure with self-regulating capacities aimed at the reproduction of the social system, according to the triadic scheme of metabolism of nature, metabolism of society and metabolic rift (Foster and Clark 2016).

In this framework, the convergence between metabolic rupture and ecological economics becomes fruitful when we recognize that metabolic regimes are also territorial regimes (Bagliani and Dansero 2011; Quaini 1982), seeking the rupture in the separation between production systems and reproduction systems, that is, between capital and territory. Recently, the hypothesis of integrating the theory of metabolic fracture into MFA (Pisinas and Papageorgiou 2025) has emerged, which requires overcoming the epistemic neutrality of flow accounting, recognizing

that every material movement also incorporates certain social relations.

The historicization of socio-metabolic regimes, read through historical materialism, allows us to analyze the evolution of the society–nature relationship starting from the elementary energy forms of hunter-gatherer societies (Haberl 2001; Haberl et al. 2004; Smil 1994), up to the break produced by industrial capitalism. Following Engels (1971), we can interpret these transitions as qualitative transformations based on quantitative accumulations, which converge into new social and metabolic orders. In this transition, metabolism becomes reterritorialized, feeding on global inputs and losing all links with local reproductive rhythms.

In light of this genealogy, the criticism that the metabolic rift hypothesis implies an idealization of pre-capitalist regimes as forms of equilibrium (Engel-Di Mauro 2014, 144) also appears questionable. Such a reading risks confusing the process with a linear and harmonious narrative of ecological evolution. In order to understand the historicity of the rupture of the society–nature nexus as a process, and not as an effect, it is worth remembering that “in previous societies had been established by the circumstances of ‘natural spontaneity’” (Quaini 1982, 129), and it is useful to refer to the history of the expropriation of the independent producer and his expulsion from the land so as not to confuse him, in the manner of Schneidere and McMichael (2010), with an artifact deriving from specific agricultural practices, disconnecting him from the overall logic of capitalist valorisation and the historical disarticulation of the cycles of reproduction.

Starting from these considerations, it seems clear that “confronted by the eco-logical and territorial maladjustments of capitalism, Marx still did not indulge in idealizing a pre-capitalistic ‘state of nature’” (Quaini 1982, 134).

If the separation of humanity from its inorganic conditions constitutes the original act of capitalist modernity, its dialectical negation can only proceed through the collective reappropriation of the human–nature metabolism. In this sense, it implies the re-foundation of territorial relations, the rearticulation of production cycles according to emancipatory aims, and the restoration of nature's character as a living condition.

In dialogue with recent elaborations on Planetary Rural Geographies (Gillen et al. 2022; He and Zhang 2022; McCarthy 2023; Wang et al. 2025), this process can be read as a co-evolutionary tension between urbanization and ruralization (Arboleda 2015; Brenner and Schmid 2015; Roy 2015), in which the persistence, adaptation, and hybridization of the rural continue to structure material reproduction within and beyond the city and its metabolism (Heynen et al. 2005; Swyngedouw 2006). The geographies of *in situ*, *extended*, and *return ruralization* (Gillen et al. 2022) show that the spatiality of ecological crisis does not coincide with the mere extension of the urban, but rather with the relational disarticulation of socio-natural regeneration cycles.

However, from a Marxist perspective, such approaches remain partial if they do not engage with the value form and with the

relations of production that determine the subsumption of rural metabolism into global circuits of accumulation. In this direction, planetary ruralization can be understood as the other face of metabolic deterritorialization, that is, as the process through which capital dissolves the city-country distinction and reorganizes the terrestrial space in accordance with abstract valorization, neutralizing the historical and political meanings of rurality.

6 | The Territory in the Spatial-Temporal Dissociation of Human Beings From Their Inorganic Nature

In geographical debate, the analytical distinction between space and territory has been extensively examined. This distinction does not posit two separate ontological domains; rather, it enables us to avoid an undifferentiated usage that risks obscuring the historical forms through which socio-natural relations are materially organized.

Space has been conceptualized as a socially produced configuration of objects, actions, and networks (Santos 1977), as well as a relational field structured by power and uneven development. The production of space, as Lefebvre (1991) argued, is inseparable from the reproduction of relations of production and from the cycle of production–circulation–exchange–consumption.

If space thus expresses the relational geometry of social processes, territory designates the historically sedimented organization of socio-spatial relations as a structured field of power and reproduction. It is not merely delimited space, but space appropriated, controlled, and reproduced through historically determined economic, political, cultural, and environmental forces. Territory is both the result and the condition of the society–nature relation; it is constituted within and through space, yet crystalizes specific relations of domination, identity, and material reproduction. Territory, therefore, emerges through processes of territorialization, deterritorialization, and reterritorialization (Raffestin 1984).

Holding space and territory together in a relation of unity, without collapsing them into synonymy, allows us to grasp both the relational geometry and the historical material architecture of the metabolic rift. The rift in the organic social renewal prescribed by natural laws, which arises from the contradiction between city and countryside, determines geographical processes characterized by a precise common genesis in the original accumulation. In fact, Quaini emphasizes how the history of primitive accumulation is expressed in major transformations of territorial structures and in the city–country relationship, in which the separation of the producer from his conditions of production (Quaini 1982, 100–102). The foundation, therefore, lies in the expropriation of the rural population and its expulsion from the land, as an “enormous phenomenon of separation of man from nature, of the producer from his workplace” (Quaini 1982, 103). According to Quaini, rural depopulation and urban concentration are two territorial processes that represent two sides of the same coin. On a purely geographical level, the divide therefore originates from a separation between independent producers and the land.

The rift manifests itself territorially as the dissolution of organic ties between human communities and the places where they reproduce. Capitalist territoriality is constituted as the territoriality of abstraction: the vital functions of the soil, biotic relationships, and hydrological and nutrient cycles are redefined solely in terms of property, rent, resources, and accumulation. The territory, thus, loses its character as a historical mediator between society and nature, becoming a functional space for the circulation of capital. This results in the destructive character of capitalist metabolism, which not only erodes the natural conditions of production but also destroys the prerequisites for regeneration.

Quaini identifies a singular geographical trend in Marx’s conception of the dissociation of humanity from the territory, the historical outcome of the transformation of the latter from use value to exchange value (Quaini 1982, 110). Quaini allows us to grasp the forms of the city–country relationship in the development of forms of social organization. Quoting Marx:

The history of classical antiquity is the history of cities, but of cities founded on landed property and on agriculture; Asiatic history is a kind of indifferent unity of town and countryside (the really large cities must be regarded here simply as royal camps, as economic works of artifice (superfetation) erected over the construction proper); the Middle Ages (Germanic period) begins with the land as the seat of history, whose further development then moves forward in the contradiction between town and countryside; the modern [age] is the urbanization of the countryside, not ruralization of the city as in antiquity.

(Marx 1973, 479)

According to Quaini, it can be said that, for Marx, the entire economic history can be summarized in the separation of city and countryside, as this forms the basis of all division of labor. Marx distinguishes between the division of *labor in manufacturing* and the division of *labor in society*. Both trends lead to urban growth, which is characteristic of the development of the capitalist mode of production and thus to a further imbalance in the city–countryside relationship. However, the two trends must be distinguished historically, as the division of manufacturing is specific to the capitalist mode of production.

In capitalism, “both the labour force and the conditions and means of work and subsistence should become commodities and as such should be exchanged in order to produce new exchange values, reproducing on an ever-increasing scale the relationships of capitalism” (Quaini 1982, 58). It is in this context that Marx’s interpretation of territorial subsumption within the circuit of valorization is rooted:

Besides that, country become land and increasingly large areas of the commodities, and exchange values are created from use values, that is to say they acquire

that abstract, alienated existence that belongs to the world of commodities, in which labour appears not as the producer of use values (as specific labour), but, as a general measure of things, of products (as equal, abstract labour), in which social relations do not appear as personal relations but as relations between things.

Marx clearly expresses the historical significance of this separation of man from nature or from the natural conditions of production, which forms the negative, or contradictory, side of the history of society's scientific, technological and productive conquest over nature (or of the development of productive forces) [...]

(Quaini 1982, 58)

The territory, once the relational and collective basis of reproduction, is reified in the abstract space of exchange, taking the form of a historical product of the capitalist social relationship, inscribed in the logic of the division between producers and means of production. Large-scale production, the subsumption of the countryside under exchange value and the structural separation between city and countryside determine a systemic rupture of the original ecological circularity (Quaini 1982; Saito 2017).

This transformation has profound geographical implications. The growing disconnection between territories of production and those of reproduction is inscribed in the very movement of capital. The capitalist system, as Marx points out very clearly, is not based simply on the technical availability of the means of labor, but on the historical and structural separation of the producer from the objective conditions of his activity. The worker presents himself on the market not as a subject endowed with autonomous means of production, but as the abstract owner of labor power alone, made available because it has been liberated from any link with the land, the community, or the collective material heritage.

These reflections place the territory within a historical–geographical materialism. Land and territory are integrated as commodities into the circuit of valorization: they are separated from their use qualities, from their ecological and historical functions, and recoded as exchangeable and alienable goods.

In this context, the contributions of materialist geography (Dematteis 1980, 1981; Indovina and Calabi 1974; Magnaghi 1976; Quaini 1982; Raffestin 1984, 1986) retain their centrality in relation to the ability to place the territory as a historical product of the contradictions between productive forces and production relations (Saquet 2015). They offer a way to counter certain tendencies toward eclecticism in contemporary critical geography, which at times struggle to restore to territory the spatial–temporal historicity of the material and symbolic reproduction of social relations of domination, resistance, and political reappropriation.

From this perspective, the aim is not to diminish the analyses that have illuminated the symbolic and identity-based dimensions of territory (Raffestin 2003), but rather to demonstrate their structural dependence on the material forms of production, consumption, and dwelling. This makes it possible to move beyond a mere juxtaposition of interpretive registers and to reaffirm the centrality of the dialectical relationship between structure and superstructure, also considering the spatial elaborations present in Antonio Gramsci's thought (Contadini 2017; Goldstein 2018).

Within the geographical debate, the project of the urban bioregion, drawing on the tradition of political ecology (Berg 1978; Bookchin 1989; Sale 1991), aims to offer an ecological perspective oriented toward closing local ecological cycles. On this basis, the eco-territorialist strand (Magnaghi 2009, 2018; Magnaghi and Marzocca 2023) has had the merit of bringing renewed attention to the ecological relations between city and countryside, to the notion of place-consciousness (on which Quaini [2010] himself also wrote), and to the need to recompose local cycles as a form of socio-environmental rebalancing. However, this approach presents several structural limits.

First, it is necessary to consider the Marxian categories of use value and exchange value within the eco-territorialist discourse to interpret the contradictory character of the alienation of eco-territorial conditions. The idea of the bioregion as a geographical context endowed with relative ecological autonomy (Magnaghi 2009) tends to overestimate the possibility of closing metabolic cycles at the local scale, overlooking the intrinsically multiscalar nature of socio-ecological processes and the global rootedness of value chains.

Second, the city—as an expression of the contradiction that incorporates territory into the circuit of exchange value, as well as a potential node within an eco-territorial network—opens a field of reflection that cannot ignore the structural relationship between urbanization, social relations of production, and the metabolic crisis.

Third, eco-territorialism tends not to address explicitly the social relations of production that underlie processes of territorial disarticulation. Although it advances a critique of the metropolis and of functionalism in planning processes, the territorialist discourse places strong emphasis on technical and design-based solutions, devoting less attention to the historical and social matrices of the metabolic disarticulations produced by capital.

Fourth, the representation of the bioregion as the outcome of the co-operative action of subjects “of different natures and functions” (Magnaghi 2023) risks producing an image of territory as a homogeneous space, in which class relations and the conflicts they entail disappear—in other words, the material contradictions that traverse territories, as well as the power dynamics that have historically structured relations of production and that are embodied and renewed precisely within those territories. In this sense, in the distinction between an “internal territory” and an “external territory”, eco-territorial reconfiguration risks resulting in an ecological adaptation

within the capitalist framework, in pursuit of an equilibrium that does not exist.

It is precisely at this point that Quaini's lesson remains decisive: only by assuming the metabolic rift as a historical-material principle is it possible to understand territory as a product of the division of labor, of urbanization, and of the reorganization of the inorganic conditions of existence. In this sense, dedicating analytical space to the metabolic rift within territorial analysis does not displace spatial inquiry, but deepens it. It allows us to specify the historically determined formations through which socio-natural disarticulation becomes territorially organized and materially reproduced.

7 | Conclusions

Marx's theory of the metabolic rift can be situated within a broader geographical genealogy, whose roots lie in the work of Massimo Quaini. His contribution, which has remained marginal within the eco-Marxist debate, makes it possible to restore to the metabolic rift a specific territorial depth, locating it within the historical dialectic that links forms of production, processes of territorialization, and the ecological conditions of social reproduction.

The analysis has shown how Quaini's work anticipates several theoretical nuclei later systematized by Foster, while embedding them within a framework more directly anchored in the dialectic between territory, labor, and nature. Within this framework, the reconstruction of the theoretical orientations that traverse contemporary critical geography—from historical-materialist dialectics to the relational ontologies of world-ecology—has clarified the risks associated with an ontological flattening of the society-nature relation. Approaches that dissolve any analytical distinction between the natural and the social tend to obscure both the specificity of the ecological contradictions generated by capitalism and the social relations of production that give rise to them. Marxist critique, by contrast, allows unity and distinction to be held together, recognizing that the interdependence between humanity and nature does not abolish the historical processes of expropriation, domination, and alienation that shape the capitalist organization of territory.

What emerges, overall, is the need to rethink the metabolic rift in territorial terms, starting from historical-geographical materialism. Such a perspective entails acknowledging that any project of socio-ecological rebalancing must confront the material conditions of production, property relations, and the historical forms of capitalist valorization; and that any genuinely emancipatory territorial reorganization can only proceed through a collective reappropriation of the metabolically and territorially grounded conditions of life.

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Conflicts of Interest

The author declares no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Endnotes

¹ Over the course of a long and distinguished scientific career, Massimo Quaini engaged with themes ranging from the methods of Marxist and radical geography to the history of cartography, cultural geography, settlement history, urban planning, and landscape studies. His first major monograph, *Marxismo e geografia* (1974), later translated into English in 1982, adopts the method of geographical historical materialism. His radical analysis within the discipline was further developed in subsequent works such as *La costruzione della geografia umana* (1975) and *Dopo la geografia* (1978), where he offered a critique of the positivist explanatory models that had dominated much of the Italian geographical debate. This critique contributed to the emergence of *Geografia Democratica* (Mangani 2021), an informal collective and intellectual movement advocating a radical transformation of the methods, aims, and organizational structures of geography as practiced within Italian universities. Active between 1976 and 1981, the group involved Quaini himself, Lucio Gambi, Giuseppe Dematteis, Pasquale Coppola, and other Italian geographers. In the following years, Quaini's intellectual legacy played a significant role in reshaping Italian academic geography.

² In the 1960s and 1970s, geography underwent a phase of epistemological crisis: the production of encyclopedic knowledge was no longer capable of interpreting the social transformations then underway. In this context, Quaini positioned himself at the forefront of a radical proposal, grounded in the Marxist method and aimed at reformulating geography as a historical and materialist science. In *Marxism and Geography*, he identified the determinism-possibilism dualism as one of the principal theoretical obstacles of the discipline. For Quaini, overcoming this dichotomy requires reconnecting geographical analysis to the material structures of history. Population, for example, cannot be understood as an abstract entity independent of social classes; classes, in turn, are intelligible only within the relations of production; and capital cannot be analyzed without its constitutive elements and material conditions of existence. His proposal—reiterated in his subsequent works—was therefore to transform human geography into a science capable of grasping spatial processes as historical forms of the society-nature relationship, founded on historical materialism in order to overcome the abstractions of determinism and possibilism through a dialectical reading of social and territorial structures (Quaini 1982, 13–14).

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