

Philosophy, Complexity, and Environment: Epistemological Framework on Contemporary Issues

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ABSTRACT

The present research aims to generate a transdisciplinary epistemological framework, from a complex philosophical understanding and interpretation with environmental thinking, that guides educational policies and practices towards sustainability, socio-ecological justice and the integration of diverse knowledge. The research was carried out using a qualitative approach with a transdisciplinary complex-philosophical discourse; the design was documentary and conceptual, synthesizing indexed literature, legal texts - including Ecuador's constitutional innovations on Good living and the rights of nature - and ancestral epistemologies. The results identify three interrelated pillars: (1) ethical synderesis as a moral disposition guiding practical deliberation, integrating ethical reflection into technical decisions; (2) Sumak Kawsay/Buen Vivir as a plural and territorially situated cosmology that supports policies of rights of nature and interspecies well-being; and (3) complexity-informed transdisciplinary governance approaches that foster coevolution, reflexivity, and adaptive learning by integrating scientific, legal, local, and ancestral knowledge. It is concluded that complexity thinking improves environmental epistemology by articulating temporal scales, normative commitments, and knowledge cultures, offering analytical clarity and operational guidance for policy, education, and participatory ecosystem management.

Keywords: Philosophy, Complexity, Environmental epistemology, Sustainability, Transdisciplinary Research.

INTRODUCTION

In Latin America, and particularly in Ecuador, constitutional innovation—most visibly the recognition of Buen Vivir (Sumak Kawsay) and the rights of nature—has produced fertile ground for epistemic experiments linking ancestral knowledge, legal pluralism, and environmental policy. Buen Vivir offers a non-anthropocentric horizon that reimagines the relationship between human communities and ecosystems. Critics have emphasized gaps between constitutional ideals and implementation realities, noting political, economic and institutional obstacles to transformative change.

At the same time, structural inequalities in access to resources aggravate these challenges. Unequal access to water in Andean highland communities, land concentration in agribusiness, and the loss of biodiversity that disproportionately affects rural and indigenous groups illustrate how environmental crises intersect with social injustice. These dynamics reveal that sustainability is not only an ecological imperative but also a question of distributive justice and cultural survival. Addressing them requires epistemological approaches that foreground equity, intercultural dialogue, and participatory governance.

The central research question is: How can complexity-informed philosophical concepts and ancestral ethical frameworks (such as Sumak Kawsay and Tikkun Olam) be synthesized to enrich environmental epistemology and support sustainable practice? To answer this question, the paper offers: (1) a critical synthesis of recent literature

on ecological complexity and transdisciplinary education; (2) an articulation of ethical synderesis as a guiding disposition for deliberative practice; and (3) a provisional conceptual model orienting education, governance, and research toward adaptive, justice-sensitive sustainability. In this sense, Latin America provides not only a conceptual but also a practical laboratory of social sustainability. Community water management systems in the Andean region, intercultural educational projects in Ecuador, and the recognition of collective rights of indigenous peoples illustrate how epistemological innovation is directly linked to social cohesion and sustainability practices. These experiences demonstrate that philosophy of complexity is not limited to abstract reflection, but informs everyday governance and community resilience.

This approach builds on the concept of Real Competences developed by (Paredes-Riera, 2020), which emphasizes relational, ethical, and situational skills relevant to education and environmental praxis. Environmental context, in particular, reveals a complex, crisis that extends current responsibilities and future consequences. The manipulation of nature causes reactive consequences, signaling a rupture produced by Entelechy human intervention which is the buildable purpose for the essential and complete self-realization of the human being.

Ecuador is globally recognized as home to millenary Indigenous cultures, isolated communities, and ethnic groups. These ancestral peoples contribute to Ecuador's constitutional designation as a Plurinational, Multicultural, and Multiethnic State (Constitution of the Republic of Ecuador, 2008). Escolástica Financiera (Paredes Riera, 2024) suggests preserving humanity by ensuring that the macro-curriculum fulfills its constitutional mandate, in harmony with UNESCO guidelines and rooted in Latin American educational realities (Paredes Riera & Paredes Riera, 2020).

We must orient ourselves toward the cultivation of noology, the science of the mind and spirit, understood as the discipline concerned with how ideas emerge, under what cultural conditions they interconnect and form self-regulating, self-defining systems of thought. We must hold, assume, and even appropriate a new understanding of human nature and offer guidance accordingly. We must learn to know and guide the human being within us, who demands development every day.

We are at the dawn of a far-reaching and profound effort aimed at enabling scientific activity to possess the means for reflexivity and self-research, governed by normative self-regulation which is potentially under a special legal framework or one that respects and empowers the norms of Ancestral Cultures. Hence arises the critical relevance of ensuring that legislators are not merely expendable media figures, but well-prepared individuals capable of addressing complex contemporary challenges. The school system keeps the responsibility for the intellectual formation of 21st-century citizens. It is the institution legally authorized to develop cognitive, procedural, and attitudinal competencies. It relates a transition from an intellectual model toward one that contributes to an integral human development (Paredes Riera & Rivera Burgos, 2020). This vision aligns with the Hebrew precept Tikkun Olam, which translation is repairing the world, as shown in Figure 1.

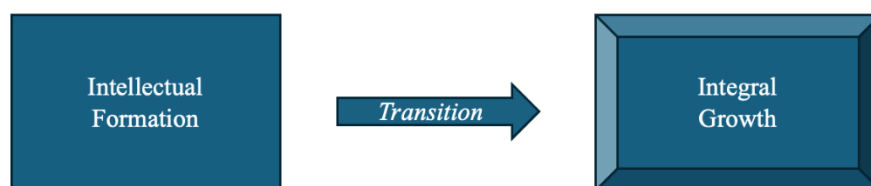


Figure 1. Transition from Intellectual Formation to Integral Growth

Note. The figure illustrates the proposed educational shift from a knowledge-centered intellectual formation toward integral human development, in alignment with the Hebrew principle Tikkun Olam (repairing the world). Adapted by the authors for conceptual purposes.

One of the most relevant topics in the Environmental Legal System over the past decade and particularly in Ecuador has been to establish comprehensive reparation mechanisms for damage inflicted upon nature. While such initiatives are commendable, they fall short without robust legal protection of the environment which is an imperative universally recognized. This search also entails a critical reassessment of the political and economic rationalities behind dominant unreal utopian productive practices, alongside the often-questionable media justification for the exploitation (and overexploitation) of natural resources, sustained by preconstructed dogmatic-communicational frameworks. This sphere of public dominion has generated a new line of theoretical discourse in academic fields, particularly oriented toward development and environmental policy. Complexity intensifies within analytical contexts due to clashing interests, ideological viewpoints, and selective rhetorical-theoretical frameworks of control mechanisms over mass production schemes.

Based on the above, the present research arose, with the main premise of generating a transdisciplinary epistemological framework, grounded in philosophy, complexity theory, and environmental thought, that guides educational policies and practices toward sustainability, socioecological justice, and the integration of diverse

knowledge. This will represent a highly important theoretical contribution in the development of educational guidelines.

METHODOLOGY

This study adopts a qualitative, documentary, and conceptual methodology appropriate to exploratory epistemological work. The research design combined targeted literature review, comparative legal analysis, and conceptual synthesis. The literature review concentrated on sources published between 2020 and 2024, prioritizing peer-reviewed articles, book chapters, and policy documents indexed in Scopus and Web of Science. Search terms included combinations of: 'complexity theory', 'ecological complexity', 'environmental epistemology', 'transdisciplinarity', 'Buen Vivir', 'Sumak Kawsay', 'rights of nature', and 'synderesis'.

Selection criteria emphasized conceptual relevance for environmental epistemology, recency (with emphasis on 2020–2024), and cross-disciplinary perspectives. Excluded sources were those that did not engage with theoretical issues or lacked verifiable scholarly provenance (e.g., non-scholarly blogs without citations). Analytical procedures followed three stages: (1) thematic coding, in which texts were reviewed and coded for recurring themes (e.g., co-evolution, normativity, plurality); (2) conceptual synthesis, where coded themes were integrated to construct higher-order categories; and (3) model-building, where synthesized categories were arranged into a provisional epistemological model for environmental praxis.

To complement the documentary analysis, the paper incorporates legal instruments and constitutional texts—particularly Ecuador's 2008 Constitution—to ground the conceptual model in specific regulatory contexts. The methodology is explicitly non-experimental and theory-driven; its primary aim is to generate a robust conceptual scaffold that future empirical research may test and operationalize. Limitations include the absence of fieldwork or primary empirical data in this iteration, and the selective—rather than exhaustive—nature of the literature corpus.

Development

Cognitive conflict in environmental issues stands up from the dispersion of knowledge and the clash of divergent, implausible, and often contradictory conclusions, frequently codified by legislators without any specialized expertise. This situation demands a contextual understanding of contributing factors and the construction of a new paradigm that transcends populist rhetoric driven by electoral convenience. Such a paradigm must be grounded in scientific evidence and oriented toward cognitive coherence, fostering a realistic, objective, and value-based viewpoint shaped by deontological and attitudinal values.

Philosophy: The Genesis of Knowledge

Philosophy is the birthplace of knowledge. It begins as the art of thinking and is subsequently organized into disciplinary bases, enabling the articulation of multiple worldviews and defining the identity of human groups who construct them. Philosophical reflection on cause and effect has historically driven solutions to pressing needs, whether through electrification, telecommunications, media overload, or climate forecasting. However, global progressive agendas have sometimes emphasized ideological distractions, privileging rhetoric over biology. The overemphasis on the inclusive “e” in the discourse of certain “peoples” or “pueblos” and of female Heads of State who adopt a neo linguistic rhetoric focused on nominal concerns has led to a kind of discursive apoplexy. In this context, the insistence on being called “presidentas” instead of “presidentes” dilutes the notion of the *entity that presides* and shifts attention away from the true political and social burdens faced by their constituents, both male and female. Meanwhile, environmental and social urgencies and emergencies are symbolically relegated to the “waiting line of the Latin American Social Security system. This includes linguistic controversies over gendered political titles and urgent environmental and social crises. This argument aligns with Foucault's critique of totalizing institutions, which outwardly uphold virtue and rights but subtly embed relations of power behind euphemistic narratives (Paredes Riera & Rivera Burgos, 2020).

The Ecuadorian Case

Ecuador presents a particular case, as it challenges the anthropocentric environmental structure by adopting a biocentric vision of development. This shift consists of a purpose in the relationship between nature and economic development through the guiding principle of Sumak Kawsay (translated as Good Living), which promotes harmonious cohabitation between the human being, society, and nature. Concrete examples include community-led initiatives such as the indigenous territorial assemblies in the Amazon region, where participatory governance regulates the sustainable use of forests, or the “mingas” (collective actions) that articulate social and ecological objectives. These practices embody Buen Vivir principles, blending ancestral cultural values with contemporary demands for social sustainability.

Yet, these community initiatives also expose the persistence of inequalities. Small-scale farmers and indigenous peoples often face legal and economic barriers in defending their territories, while extractive industries enjoy privileged access to natural resources. The epistemological framework of Buen Vivir thus becomes a counterbalance, providing not only a philosophical vision but also a social instrument for contesting inequity and reclaiming participatory rights over land, water, and forests. In this sense, environmental sustainability is inseparable from social cohesion and cultural resilience.

It lines up sustainability for the population by recognizing nature as a subject of rights. This proposal aims to offer an epistemological perspective rooted in philosophical reflection and complexity theory as shown in Figure 2.

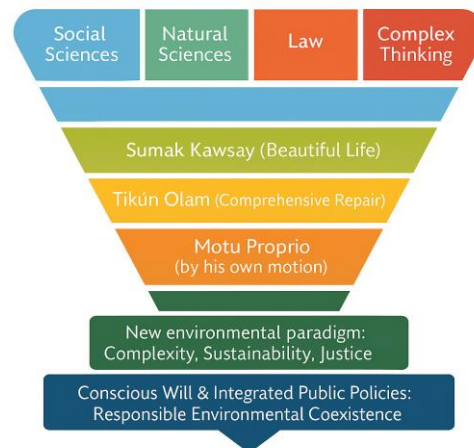


Figure 2. New Environmental Paradigm: Complexity, Sustainability, Justice.

Note. This figure represents the conceptual model of a new environmental paradigm proposed in the study, integrating principles of complexity theory, sustainability, and socio-environmental justice. Adapted by the authors to illustrate the epistemological framework.

Theoretical Framework

All inhabitants of the planet are entirely dependent on the terrestrial ecosystem and the multiple services it provides. Over the past century, human activities focused on the exploitation of non-renewable resources, land-use changes, and disruption of biogeochemical cycles, have resulted in the destruction of habitats for endemic species, many of which are now extinct or endangered. These changes have significantly affected the natural, self-regulating functions of ecosystems, often at a faster rate than at any previous time in past. The loss of biodiversity is normally exploited for profit, and without bioremediation, this leads to the destruction and loss of an endemic natural context, replaced by farmland, land subdivisions, the reduction of natural sources of cooling and oxygenation, decreased biodiversity, and water pollution, which in turn reduces the availability of potable water. It is astonishing that large economic budgets are allocated to the search for water on Mars, while no binding action is taken to enforce the comprehensive restoration of Earth's ecosystems.

The issue was formally addressed in 1990 during the first Ministerial Conference for the Protection of Forests in Strasbourg, France, which proposed criteria and indicators to standardize sustainability assessments. In countries like Colombia, Ecuador, and Peru, efforts have been directed toward the Andean watersheds, where environmental externalities are being quantified and evaluated to identify viable alternatives. The goal is to assess the impact of different uses of land and prioritize areas with the greatest potential for mitigating negative externalities, guiding resources to where change is needed in order to maintain equilibrium.

The Millennium Declaration, approved by the United Nations General Assembly, recognizes respect for nature as a fundamental value, promoting the conservation and transmission of the Earth's resources and benefits to future generations. From a legal viewpoint, concern over environmental protection has fostered the emergence of Environmental Law, considered a third-generation right, which reflects the social conception of communal life and collective efforts to expand protected areas and environmental services. However, insufficient financial resources to manage these "protected areas" remain a serious threat to ecosystems and the continuity of the benefits they provide, rendering it a transgenerational trouble.

Enrique Leff introduces the notion of socio-environmental formation by integrating Karl Marx's socio-economic concepts, Max Weber's rationality, and Michel Foucault's discursive formations (Leff, 1997). Angel Maya also contributes significantly to this field, emphasizing a historical perspective based on the dialectical analysis of the historical and the logical, it provides a significant reconstruction of the historical relationship between humanity and nature from an environmental perspective (Angel Maya, 1998).

Transdisciplinarity: Method and Conception

This proposal seeks to elevate the transdisciplinary interpretation of reality as both a method and a worldview aligned with the principles of contemporary science. *Dianoia* arises from the dynamics of conflict that define the interrelationships between society and nature, along with all the processes that emerge from this relationship. The aim is not to produce a totalizing theory nor to indulge in rhetorical scientific discourse. Rather, producing on Foucault's analytical framework, we are invited to produce our own epistemological and social questions, once we have not only understood but truly comprehended our contextual reality, moving from mere spectators to active agents, from the statements supported by Dussel (2012), "Latin America is left out of world history, much like Africa, despite a supposed Trinity (Europe, Asia, and Africa) Africa remains equally disregarded", The author's analysis reminds us that we are governed not only academically by external theories, and that Latin America still struggles to achieve a true independence, one that fosters experiential education with social responsibility, where each social actor learns to think based on the realities they observe; i.e., legitimacy..

Complexity, Materialism, and Positivism

Dialectics, as a theory of development, stands in opposition to the extrapolation of laws that govern specific levels of material complexity onto higher orders. This perspective assumes that environmental problems are inextricably linked to the dynamics of both natural and social development. It is within these dynamics that we must search for their essence, contradictions, and potential solutions.

Considering of the environment grounded in Historical Materialism which employ Marxist categories for the analysis of society these approaches introduce a predisposition in the understanding of reality by absolutizing social laws as essential. often maintaining an anthropocentric and economically essential perspective (Leff, Gutman, among others). It is important to clarify that the classical philosophical debate between materialism and idealism culminated in the 19th XIX century, with positivism and dialectical stands on materialism adopting mutually exclusive methodological conceptions. Positivism is grounded in a metaphysical understanding of development, whereas dialectical materialism approaches reality with a logical comprehension of change and its inherent processes.

We begin with a generative question: How does a metaphysical framework limit the contemporary discourse on environmental perception? This inquiry exposes the metaphysical methodological prejudices that obstruct a comprehensive theoretical understanding.

If relationships between immutable essences are defined as equally unchangeable, this constitutes a metaphysical view of those relationships. If movement is conceived as something externally imposed, an alteration of stillness rather than its opposite, then we are faced with a metaphysical conception of motion, in which laws are declared unchangeable despite their constant activity and emergence of new outcomes. This, in essence, is the metaphysical conception of development (Orudzhev, 1973).

Dianoia: Society–Nature Relationship

The concept of *dianoia* between society and nature is inherently reciprocal. It reflects the principle of feedback or retroactive loops (Morin, 2001), where cause affects effect and effect reshapes cause. In this sense, nature is a precondition for societal existence, while society arises through the economic-productive processes derived from its interaction with the natural world. Rising temperatures in tropical zones are a direct consequence of deforestation, the systematic elimination of forested land that sustains the planet's oxygen levels and provides habitat for endemic species. The extinction of countless organisms, and the impending disappearance of many more, is not merely tragic, it is cruel. These losses are often the result of expansionist urban planning: malls, highways, buildings, or monocultural plantations.

Reality is far broader than the conceptualizations we may be able to express. The "environmental" category expresses a profound factual abstraction of many concrete expressions that can only be recognized through their deep existence in the world (tangible), movement, space, time. The complexity of environmental issues has matriarchal origins, dating back to the earliest forms of human organization and functional primitive delegation. These have evolved into today's material systems, constantly transforming through phases of progress, regression, and reorganization of living organism systems.

The historical evidence of environmental crises emerges from specific phenomena born of the exploitation–conservation dichotomy, a dilemma long debated between economics and ecology. The traditional society–nature relationship has evolved into a triadic understanding of human being–society–nature, along with a recognition of the inalienable rights of *Pachamama* (Mother Earth). This is not a biased interpretation; it represents the essence of the holographic principle, a perspective not grounded in historical justifications but rather in a sincere and pressing interest.

As Paredes-Riera states: "The breakdown of the traditional paradigms in the Ecuadorian education system has given rise to the urgent need to incorporate the omnipresence of the society of knowledge into the skill

development framework. The solutions are multiple and varied to fit different requirements, with effectiveness affected by context" (Paredes-Riera, 2020). This reality is particularly evident in Ecuador, and increasingly across Latin America.

RESULTS

Method cannot be dissociated from theory or scientific conception. The treatment of environmental issues arises from context-sensitive philosophical methodologies embedded within contemporary transdisciplinary environmental discourse, often enhanced by mathematical modeling and logical-ontological variables drawn from empirical reality.

In many cases, the actual (natural) conditions for the production of material goods remain unknown, frequently obstructed by officials who have been unduly influenced by offerings from producers or agents responsible for transforming the natural environment.

The documentary and conceptual analysis yields three interrelated results that form the backbone of the proposed epistemological framework.

Result 1: Ethical Synderesis as Moral Orientation. The first result highlights synderesis—understood here as a habitual disposition for practical moral insight—as central to environmental epistemology. Synderesis functions as a cognitive-affective anchor that orients agents toward non-instrumental values in ecological decision-making. By foregrounding synderesis, the model seeks to integrate ethical reflection into technical deliberations (e.g., impact assessments), thereby reducing the tendency for purely technocratic solutions to overlook moral responsibilities toward non-human entities and future generations.

Result 2: Sumak Kawsay / Buen Vivir as Place-sensitive Normative Resource. The second result identifies Buen Vivir as a plural and contextually situated normative repertoire that can inform rights-based approaches to environmental governance. The constitutional recognition of nature's rights in Ecuador provides a juridical substrate for policies that prioritize ecosystem integrity and interspecies well-being. However, the literature also documents implementation challenges, indicating that constitutional recognition alone does not guarantee effective environmental protection. Therefore, the epistemic task is to translate normative principles into workable institutional mechanisms that are responsive to local social-ecological dynamics.

Result 3: Complexity-informed Transdisciplinary Governance. The third result underscores the practical promise of complexity theory and transdisciplinary methods for governance and education. Complexity thinking reorients attention to feedbacks, path-dependence, tipping points, and emergent properties in socio-ecological systems; transdisciplinary practice enables the integration of scientific, legal, local, and indigenous knowledges. Applied to education and policy design, these approaches support adaptive management, scenario-building, and reflexive stakeholder engagement. Recent reviews emphasize the need for cohesive strategies that bring together diverse epistemic communities to co-produce knowledge and solutions relevant to local contexts (Riva et al., 2023; Baumber, 2022). This emphasis on moral orientation and situated skills aligns with Paredes-Riera's (2020) framework of Real Competences, which integrates ethical discernment into professional practice.

Table 1. Synthesis of the Three Main Results and Their Implications

Result	Core Idea	Implications for Environmental Epistemology	Connection to Discussion
1. <i>Ethical Synderesis</i>	Moral disposition guiding ecological decisions	Integrates ethics into technical deliberation	Bridges normative commitments with actionable practices
2. <i>Sumak Kawsay / Buen Vivir</i>	Place-sensitive normative repertoire	Supports rights of nature and interspecies well-being	Anchors governance in intercultural, context-based justice
3. <i>Complexity-informed Governance</i>	Integration of diverse knowledge through transdisciplinarity	Enables adaptive, reflexive, and participatory management	Provides operational tools for education, policy, and ecosystem restoration

Note. This table summarizes the three core results of the study—ethical synderesis, Sumak Kawsay/Buen Vivir, and complexity-informed governance—highlighting their conceptual contributions, implications for environmental epistemology, and connections to the subsequent discussion.

DISCUSSION

From a social sustainability perspective, the integration of complexity and ancestral epistemologies highlights how cohesion and participation are indispensable. Community assemblies, intercultural schools, and participatory budgeting processes embody forms of governance where citizens co-decide on the distribution of resources and priorities for ecological protection. These practices show that collective resilience is achieved not only by legal recognition but also by strengthening the bonds of trust, reciprocity, and shared responsibility across diverse social actors.

Contextualized theoretical and legal foundations form the normative and epistemic scaffolding that limits and regulates the exploitation of non-renewable resources. These foundations also define compensatory and indemnification frameworks for irrational or large-scale use of such resources. Legal norms and their hierarchies must be genuinely harmonized and articulated through the involvement of individuals with verifiable expertise in the field, academics, legal scholars, certified researchers, and ancestral representatives, thus enriching the development of juridical indicators and legal guidelines and eliminating the problem of "dead-letter law."

The breakdown of traditional paradigms in Ecuadorian education stems from the urgent necessity to embrace the omnipresence of the knowledge society. Proposed solutions are diverse, though their effectiveness often depends on contextual adaptability. While not a panacea, this proposal affirms the efficiency and effectiveness of a flexible, competent, and competitive academic training model that contributes to the country's sustainable development, in alignment with regional counterparts and oriented toward international competitiveness (i.e., professional escalation). It responds to the needs of communities, fostering warm human relations, cooperative and assertive behavior, and the achievement of goals based on real, factual evidence and both sustainability and resilience. A standard educational model based on real competencies, communication, and the satisfaction of human needs in accordance with the ecosystem legitimizes training processes in real-life settings through cooperation (Paredes-Riera, 2020).

The three results above converge on a single normative claim: addressing environmental crises requires epistemological pluralism combined with institutional forms capable of learning, adaptation and ethical discernment. The inclusion of *synderesis* within environmental epistemology helps bridge the gap between normative commitment and actionable practice. In settings where technical expertise dominates, *synderesis* can serve as a corrective, reminding practitioners that ethical awareness must precede and accompany technical choices.

Embedding *Buen Vivir* into legal frameworks creates opportunities for reorienting development trajectories away from extractivism and toward regenerative practices. Nonetheless, constitutional recognition of nature's rights must be accompanied by participatory institutional mechanisms, local capacity-building, and procedural safeguards to avoid capture by political or economic interests. This is consistent with broader findings on the limits of legal innovation absent supportive governance arrangements.

Complexity theory contributes methodological and conceptual tools for operationalizing these normative commitments. By conceptualizing socio-ecological systems as adaptive networks, planners and educators can anticipate unintended consequences, design flexible policies, and create monitoring systems sensitive to emergent changes. Such an approach requires new competencies among professionals, including systems thinking, transdisciplinary collaboration, and ethical reflexivity. Educational programs that adopt transdisciplinary, challenge-led designs have demonstrated the potential to cultivate these competencies in students and stakeholders (Baumber, 2022).

Finally, the synthesis underscores a research and practice agenda: first, developing curricular materials that integrate *synderesis* and complexity pedagogy; second, designing participatory processes for rights-of-nature litigation and ecosystem restoration that respect indigenous knowledge; and third, implementing pilot case studies that test the conceptual model in diverse ecological contexts (e.g., Andean watersheds, coastal mangroves, urban green infrastructure). These steps will help validate and refine the proposed epistemological model. Moreover, the call for new professional competencies that include ethical reflexivity and relational skills echoes (Paredes-Riera, 2020), who argues for the centrality of 'real competences' in curricula oriented toward complex, real-world problems. This aligns with evidence from organizational sustainability studies (Altassan & Ahmad, 2024), which show the importance of integrating human factors into environmental responsibility frameworks.

This work is conceived within the framework of the New Educational World (NME) through hermeneutic reflection, as part of an R&D+I project at the Universidad Tecnológica Empresarial de Guayaquil. It promotes the normalization of transdisciplinarity and complex thought as an educational syncretism, cultivating real-world competencies and scholastic inquiry, in alignment with both the University's Doctorate in Education of Universidad Tecnológica Empresarial de Guayaquil and the Doctorate in Complex Thought and Transdisciplinary Knowledge Construction offered by the Edgar Morin Real World Multiversity.

CONCLUSIONS AND RECOMMENDATIONS

This paper argues that integrating philosophical reflection, complexity theory, and transdisciplinary practice produces a richer, more action-oriented environmental epistemology. The proposed model—centered on ethical synderesis, Sumak Kawsay / Buen Vivir, and complexity-informed governance—offers a conceptual pathway for linking normative commitments to institutional design, educational reform, and policy innovation.

The study highlights that social sustainability emerges not only from normative frameworks but from lived practices. The integration of ancestral governance systems, community-based ecological restoration (such as páramo reforestation projects), and participatory rights-of-nature litigation provides tangible evidence of how complexity-oriented epistemologies shape inclusive, equitable, and sustainable futures.

Curriculum innovation. Educational programs should incorporate modules on complexity, ethical discernment (synderesis), and intercultural knowledge into environmental and professional training. These elements must be connected in a coherent manner, and adaptive pilot projects should be developed to operationalize rights-of-nature principles in collaboration with indigenous communities and local stakeholders.

Transdisciplinary platforms. Based on transdisciplinary approaches, it is essential to foster spaces for the co-production of knowledge that bring together scientists, legal experts, indigenous representatives, and civil society actors. Priority should be given to field-based research that can test the model's effectiveness and refine its underlying assumptions.

The limitations of this study must also be acknowledged. As the research is conceptual and documentary in nature, it requires future empirical validation and case studies. Nevertheless, the framework presented here provides an initial foundation for integrating ethics, complexity, and plural knowledge systems into practical responses to contemporary environmental challenges.

In line with Paredes-Riera (2020), we recommend curricular innovations that foreground real competences—such as ethical judgment, relational skills, and situational adaptability—to better prepare practitioners to address socio-ecological complexity. By embedding these competences within higher education and professional development, institutions can contribute not only to sustainability but also to the cultivation of reflexive, justice-oriented, and environmentally responsible citizen.

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