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Environmental education and local knowledge in response to climate change in intercultural bilingual schools

Educación ambiental y saberes locales ante el cambio climático en escuelas interculturales bilingües

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ABSTRACT

This article presents the results of two research projects aimed at analyzing the narratives and practices that emerge in teaching–learning processes on climate change in rural and intercultural bilingual schools in southern Ecuador, considering the socio-environmental challenges faced in these territories. The study involved 9 teachers, 120 students, and 7 local stakeholders from the provinces of Azuay and Cañar. A qualitative methodology was employed, based on semi-structured interviews and the creation of talking maps, using non-probabilistic convenience sampling. The findings reveal that climate change is perceived as a highly technical phenomenon, disconnected from local environmental dynamics as well as from national and international policies. Nevertheless, local stakeholders highlight that environmental degradation represents not only an ecological crisis but also a symbolic and cultural rupture that undermines the identity of their communities. In conclusion, the study demonstrates that climate change continues to be framed exclusively within the natural sciences; therefore, it is essential to foster a contextualized, critical, and transdisciplinary environmental education.

Keywords: *climate crisis; local knowledge; interculturality; rural schools; environmental education.*

RESUMEN

El presente artículo es resultado de dos proyectos de investigación cuyo objetivo se centró en analizar las narrativas y las prácticas que emergen en los procesos de enseñanza-aprendizaje sobre el cambio climático, en unidades educativas rurales e interculturales bilingües del sur ecuatoriano, considerando los desafíos socioambientales que enfrentan estos territorios. La investigación se realizó con la participación de 9 docentes, 120 estudiantes y 7 actores locales de las provincias de Azuay y Cañar, mediante una metodología cualitativa basada en entrevistas semiestructuradas y la elaboración de mapas parlantes, a partir de un muestreo no probabilístico por conveniencia. Los resultados evidenciaron que el cambio climático es percibido como un fenómeno altamente tecnificado y desvinculado de las dinámicas ambientales locales y de las políticas nacionales e internacionales. No obstante, los actores locales destacan que la degradación de la naturaleza no solo representa una crisis ecológica, sino también una fractura simbólica y cultural que debilita la identidad de sus pueblos. Como conclusión, estos hallazgos evidencian que el cambio climático sigue posicionándose como un tema exclusivo de las ciencias naturales; por lo tanto, es necesario promover una educación ambiental contextualizada, crítica y transdisciplinaria.

Palabras clave: *crisis climática; saberes comunitarios; interculturalidad; unidades educativas rurales; educación ambiental.*

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INTRODUCCTION

Environmental education is a formative process aimed at fostering in individuals a critical awareness, as well as the values, attitudes, and capacities needed to understand the interrelationships between human beings and their environment (natural, social, and cultural).

Today, climate change stands out as one of the most urgent challenges of our time, posing major demands for educational systems, particularly in rural areas of Latin America shaped by poverty and structural racialization, as is the case in various regions of Ecuador. Even so, according to Merizalde Conza et al. (2025), formal environmental education on climate change remains insufficient and is often centered on the transmission of decontextualized content. As a result, educational communities are limited in their ability to reflect critically on the immediacy of the problem and on its direct impact on territories, ways of life, and sociocultural dynamics.

To better understand the foundations of environmental education, it is necessary to examine how its approaches have evolved over time. In this regard, some authors note that its main currents were shaped in two broad historical moments (Robertson et al., 2025). The first emerged in the 1970s and 1980s, whereas the more recent currents arose in response to contemporary challenges beginning in the 1990s and have continued to evolve alongside the rise of climate summits up to the present.

These early currents were influenced by the United Nations Environment Programme (UNEP) through strategies for environmental education and training. This phase includes the following approaches: naturalist, conservationist, and ecopedagogical (Vallejo Ronquillo, 2022). By contrast, current posthumanist proposals have incorporated approaches such as the holistic, critical, ethnographic, and sustainability-oriented perspectives. These frameworks provide critical tools for analyzing socio-environmental inequalities linked to phenomena such as climate change.

From this perspective, although climate change affects society as a whole, its consequences fall most heavily on impoverished populations, which have borne minimal responsibility for its origin (Ulloa Cubillos, 2023; Terrón Amigón et al., 2020). This inequality reveals a form of social injustice tied to the global economic model and its unsustainable practices. In response to this reality, the notion of planetary consciousness becomes especially relevant. According to Morin (2004), such awareness makes it possible to critically understand the interrelationship among humanity, the planet's evolution, and the universe, while recognizing the connection between nature and the diverse forms of life it sustains.

From Leff's (2000) perspective, environmental education should move toward a pedagogical transformation that links the ecological dimension with the cultural and social realities of those involved in educational processes, thereby proposing a situated and contextualized form of education.

Another challenge facing environmental education is understanding it as an issue that has been excluded from geopolitical power relations. For López Helgero and Aguirre Coello (2025), reducing it to an exclusively biological approach implies assuming an apparent ideological neutrality that fails to reflect the complexity of socio-environmental problems, which are deeply intertwined with the political and economic dynamics of the contemporary world.

Along these lines, Gudynas (1998) and Freire (1993) argue that valid and transformative environmental education must challenge such neutrality by integrating the social and natural sciences in a coherent and articulated way. Because of its political character, environmental education does not merely serve an informative function; it must also aim to transform the social structures that sustain the dominant civilizational model, thereby promoting a critical praxis committed to social change (Manzanero Rivero, 2023).

In the Ecuadorian context, the institutionalization of environmental education within the educational system began in 2001 through cooperation agreements between the Ministry of the Environment and the Ministry of Education, intended to facilitate its incorporation into the curriculum (Vallejo Ronquillo, 2022). This interinstitutional coordination took shape in the formulation of the National Environmental Education Plan, aimed at the levels of basic education and upper secondary education and implemented between 2006 and 2016 (Guamán Gómez & Espinoza Freire, 2022).

Later, in 2010, under the leadership of the Ministry of Education and with technical support from the Ministry of the Environment, climate change was incorporated as a central axis of the educational agenda, since it was regarded as "the greatest environmental problem currently affecting the planet" (Ministerio del Ambiente del Ecuador, 2017, p. 107).

The basic and upper secondary curriculum in Ecuador includes content related to environmental education (Vallejo Ronquillo, 2022). Even so, doubts

remain regarding teachers' preparation to address these issues effectively, as well as the institutional support they receive in both public and private contexts. Assessing these aspects is essential in order to determine whether the educational process is actually achieving its goals with respect to climate change or whether, on the contrary, institutions are not adequately prepared to educate students on this issue (Clavijo Cevallos et al., 2024).

In addition, it has been argued that, at the national level, the dissemination of educational projects aimed at fostering environmental awareness remains limited (Falconí Benítez et al., 2019), despite the implementation of recent initiatives such as Tierra de Niñas, Niños y Jóvenes para el Buen Vivir (TiNi) and the National Environmental Education Strategy (ENEA) of the Ministry of the Environment, whose methodologies began in 2017 with projections extending to 2030.

Within this context, the present article, which is the result of two research projects, aimed to analyze the narratives and practices emerging in teaching-learning processes related to climate change in rural and intercultural bilingual educational institutions in the provinces of Azuay and Cañar, in southern Ecuador, from the perspective of teachers, students, and local actors. Finally, it should be noted that this research focuses on analyzing the micro-curriculum implemented in each educational institution, without directly addressing the guidelines of the national macro-curriculum.

METHODOLOGY

The study was conducted using a qualitative, exploratory approach, in line with Mora Ramírez (2022) and Hay and Cope (2021), who argue that this theoretical-methodological stance is intended to deepen understanding of a specific problem rather than to extrapolate findings to other contexts. The research was based on collective case studies intentionally selected according to heterogeneity criteria, following the methodological strategy of Terrón Amigón et al. (2020), who examined representations of climate change among teachers and local knowledge holders in rural and Indigenous contexts in Mexico.

The research was conducted in southern Ecuador, in the provinces of Azuay and Cañar, over a two-year period (2022–2025). In Azuay, the educational institutions included were the Unidad Educativa Intercultural Bilingüe Monte Sinaí, located in the parish of Santa Ana, in the community of Sigsigcocha, and the Escuela de Educación General Básica 29 de Julio in the parish of Tarqui, community of Chilcachapar. In Cañar, the Unidad Educativa Intercultural Bilingüe Quilloac, located in the parish of Quilloac, was included.

This research relied on non-probabilistic convenience sampling. In other words, the sample was selected according to convenience criteria defined by the researchers, allowing them to determine non-randomly the number of participants included in the study (Hernández González, 2021). Accordingly, the study population consisted of teachers and students between 14 and 18 years of age, belonging to the upper basic education and upper secondary levels in rural and intercultural educational institutions in the provinces of Azuay and Cañar. In addition, local actors were included, specifically community leaders affiliated with social organizations such as water boards and community improvement committees.

The selection of these educational institutions, and of the teachers and students within them, was based on the existence of prior institutional links established through educational research projects conducted in basic and upper secondary education. Thus, the entire teaching staff in charge, along with students from the educational levels mentioned above, was included: 6 teachers in the institutions in Azuay and 3 in the institution in Cañar, as well as a total of 120 students.

As for the community leaders, the inclusion criterion was their status as older adults recognized for their local wisdom, as well as the active role they play in decision-making related to the management and protection of the natural elements of their territories within community spaces. A total of 7 community leaders took part: 3 men and 1 woman in the communities of Sígsigcocha and Chilcachapar, while 3 men participated in Quilloac.

This study initially applied semi-structured interviews; in a second stage, narrative drawings were used; and, finally, the findings were examined through discourse analysis. This methodological combination made it possible to approach the same phenomenon through diverse experiences and socio-territorial contexts (Romero Urréa et al., 2022).

In this regard, 15 semi-structured interviews were conducted exclusively with teachers and local actors (Caballero Merlo, 2025), since this technique made it possible to obtain contextualized perspectives on the narratives, practices, and challenges surrounding environmental issues in their respective localities (Hay & Cope, 2021). These interviews contained 15 questions, organized into four thematic axes: 1) perceptions of climate change; 2) its causes

and impacts at the global and local levels; 3) local knowledge and practices related to the care and management of natural elements; 4) what is taught and assessed in environmental education, specifically with regard to climate change (this fourth axis was addressed only with teachers).

On the other hand, participatory mapping ("talking maps") was used exclusively with students. This methodological tool enabled participants to draw and represent their territory based on their own knowledge, experiences, needs, and perspectives (Laituri et al., 2023). Unlike conventional technical maps, these cartographies are not intended solely to achieve geospatial precision, but rather to express the symbolic, social, and cultural dimensions of lived space. It should also be noted that no interviews were conducted with minors, since, depending on their stage of cognitive development, they may face limitations when reflecting on complex issues (Reyes Domínguez, 2022).

The participatory mapping technique was implemented in the form of nine workshops designed specifically for students. During the workshops, the steps suggested by Malizia et al. (2021) for identifying spatial narratives were followed. Accordingly, the students were organized into groups of five. Each group worked with a large sheet of paper showing the previously delimited territory of their locality, along with markers in different colors.

The instructions for this technique were divided into four stages (Malizia et al., 2021):

1) Identifying and marking the elements of the community they considered most significant, whether because of their historical, symbolic, or everyday value, or because they were associated with local legends.
2) Representing those places graphically and naming them.
3) Selecting the sites that had been affected, altered, or transformed by pollution, landslides, or other human or natural actions.
4) Sharing their reflections in a general plenary session.

Throughout the process, the participants' voices were recorded, and the maps produced were scanned for subsequent systematization.

The information was processed using an inductive content analysis approach, applying techniques of analogy and similarity, as proposed by Fernández-Osorio et al. (2025). In this sense, the analysis followed these stages: interview transcription, pre-analysis, definition, general categorization, and interpretation. Six categories were identified (see Table 1).

Table 1
Categories of identified narratives

Type of narrative category	Interpretation
Category 1 (Cat. 1)	Refers to understanding climate change as a physical, global, and future phenomenon; a topic of interest within the natural sciences. These perceptions are aligned with an institutional discourse.
Category 2 (Cat. 2)	Refers to understanding climate change as a physical but cyclical phenomenon, with a strong grounding in the Andean Indigenous worldview.
Category 3 (Cat. 3)	Refers to understanding climate change as a physical phenomenon, while also highlighting the strong presence of community-based resilient actions that call for political decision-making.
Category 4 (Cat. 4)	Refers to understanding that one of the main consequences of climate change is its impact on agricultural and food-related practices, leading to illness as well as poor or reduced agricultural production.
Category 5 (Cat. 5)	Refers to understanding that one of the main consequences of climate change is migration and, therefore, the disintegration of the family, which is the core unit that sustains both rural life and society.
Category 6 (Cat. 6)	Refers to understanding that one of the main consequences of climate change is the disappearance of natural elements such as mountains, forests, and rivers, where spirits and sacred beings dwell. Consequently, this also entails the loss of stories, legends, origin myths, and even the place names of a society.

In the case of the talking-map drawings, both the visual representations and the accompanying notes, together with the transcriptions of the voice recordings, were taken into account for their interpretation and subsequent systematization.

Finally, it is important to note that, throughout the research process, approval was obtained from the Bioethics Committee authorized by the national government, along with the corresponding protocols related to informed consent for teachers, local actors, and the parents or legal guardians of the students, in addition to informed assent for minors. Before the consent forms were signed and assent was obtained, an explanation of the contents of these documents was provided.

RESULTS

Demographic characteristics of the participants

This section characterizes the participating teachers, local actors (community leaders), and students according to the variables of sex, age, language, and place of origin. In the schools of Santa Ana and Tarqui, female teachers predominate, whereas

Table 2
Predominant demographic characteristics of the participants

Teachers			
Variables	**Unidad Educativa Intercultural Bilingüe Monte Sinaí (Santa Ana)**	**Escuela de Educación General Básica 29 de Julio (Tarqui)**	**Unidad Educativa Intercultural Bilingüe Quilloac (Quilloac)**
Age	32–60 years	32–45 years	32–45 years
Sex	3 women	2 women, 1 man	2 men, 1 woman
Place of origin	1 from Cuenca, 1 from Santa Ana, 1 from Chimborazo Province	3 from Cuenca	3 from Quilloac, Cañar
Languages spoken	Kichwa and Spanish	Spanish	Kichwa and Spanish
Professional profile	3 holders of a Bachelor's degree in General Basic Education	3 holders of a Bachelor's degree in General Basic Education	2 holders of a Bachelor's degree in General Basic Education; 1 higher technologist in Agroecology
Local actors			
Variables	**Santa Ana**	**Tarqui**	**Quilloac**
Age	60–90 years	50–80 years	50–80 years
Sex	1 man, 1 woman	2 men	3 men
Community role	1 former community president; 1 woman community leader	1 community president; 1 president of the drinking water board	2 former community leaders; 1 former president of the water board
Cultural identity	Indigenous campesino	Campesino	Indigenous
Languages spoken	Kichwa and Spanish	Spanish	Kichwa and Spanish
Students			
Variables	**Unidad Educativa Intercultural Bilingüe Monte Sinaí (Santa Ana)**	**Escuela de Educación General Básica 29 de Julio (Tarqui)**	**Unidad Educativa Intercultural Bilingüe Quilloac (Quilloac)**
Age	14–18 years	14–18 years	14–18 years
Sex	23 women, 9 men	19 women, 9 men	37 women, 23 men
Number of students	32 students	28 students	60 students
Languages spoken	Kichwa and Spanish	Spanish	Kichwa and Spanish

in Quilloac male teachers are more prevalent. In Quilloac, all teachers are originally from the community, unlike the other cases, where they come from the city of Cuenca. Most are bilingual (Spanish and Kichwa) and trained in General Basic Education, with one teacher standing out as a technologist in Agroecology, trained locally. With regard to the local actors, men between 50 and 90 years of age predominated. These individuals have played important community leadership roles and identify themselves as campesino or Indigenous, reflecting the cultural diversity of the area. Bilingualism remains present in Santa Ana and Quilloac, whereas in Tarqui only Spanish is spoken. As for the students, their ages range from 14 to 18 years, with the students of the Quilloac Intercultural Bilingual Educational Unit being the most prominent group; they are fluent in both Kichwa and Spanish (see Table 2).

Teaching practice in environmental education

This section presents the results obtained from the main questions posed to teachers during the study.

A) Question 1: What are teachers' perceptions of climate change and its impact on people's lives?

Teachers at the Monte Sinaí and 29 de Julio schools perceive climate change as Category 1, that is, as a fundamentally environmental and physical problem. In their explanations, they refer to variations in temperature, soil alteration, erosion processes, and disruptions in planting cycles caused either by excessive rainfall or by drought. They also understand it as a global phenomenon whose origin they attribute primarily to the activities of large foreign companies, although they recognize that it is intensified by practices such as throwing garbage into the streets or into nature.

By contrast, teachers at the Unidad Educativa Intercultural Bilingüe Quilloac understand climate change as Category 2, or as a cyclical process that has accompanied humanity throughout its history and forms an inherent part of life on the planet. Even so, they acknowledge that it currently constitutes a serious problem because of its persistence and the intensification of its effects. In this section, two clearly differentiated perspectives emerge: one that is technified and general in scope, and another rooted in the Indigenous worldview.

B) Question 2: In what part of your community do you think alterations caused by climate change have occurred?

At first, teachers referred to ideas associated with Category 1, citing examples of climate change impacts in distant settings, such as polar ice melt or rising sea levels in cities like New York. However, they also identified effects linked to their own realities, such as landslides and forest fires.

In the case of the Unidad Educativa Monte Sinaí, teachers identified the progressive disappearance of Lake Sígsigcocha as one of the main impacts (Category 6). For their part, teachers at the 29 de Julio School highlighted the issue of water scarcity, which is generating tensions and undermining social cohesion. Finally, in Quilloac, where for the Cañaris—a constitutionally recognized Indigenous nationality—life is organized around an agrocentric worldview, teachers expressed concern mainly about the negative effects of climate change on agriculture, crops, and livestock, which constitute the core of both their livelihood and their culture; in other words, they framed it as Category 4. Taken together, these testimonies show how teachers' perceptions of climate change shift from a global vision to a localized understanding shaped by direct experience and the sociocultural characteristics of each territory.

C) Question 3: What actions can be promoted through formal education to address climate change?

Teachers at the Monte Sinaí and 29 de Julio schools stated that, in their experience, responses to climate change within the school setting are linked to caring for the school garden and to a sense that political authorities bear responsibility for addressing the problem, which corresponds to Category 3. Meanwhile, teachers at the Unidad Educativa Intercultural Bilingüe Quilloac offered a broader and more community-based perspective, linked to Categories 5 and 6. They mentioned as key elements for confronting climate change practices associated with the Andean chakra, the use of the ancestral agricultural calendar, community participation and collective organization in decisions regarding the management of natural elements, and the promotion of food sovereignty and agroecology. In this section, the responses point not only to individual responsibilities but also to collective ones, especially of a political and administrative nature.

D) Question 4: What is taught and assessed in environmental education (climate change), and what teaching methodology and time allocation are used?

At the Monte Sinaí and 29 de Julio schools, climate change is addressed within integrated projects in Arts Education, as well as in the subject of Natural Sciences, through the TiNi program, which focuses on the establishment of school gardens as a pedagogical strategy to promote care for the environment.

Teachers also reported using practical strategies such as walks to natural areas, work in school gardens, and reforestation activities with native species. In addition, they incorporate brief reflections on everyday actions related to environmental care, such as not littering, using water responsibly, and reducing the use of agrochemicals.

In contrast, at the Unidad Educativa Intercultural Bilingüe Quilloac, environmental education is not conceived as a specific subject, but rather as a philosophy and cross-cutting axis that guides the entire educational proposal. This institution follows the principles of the Intercultural Bilingual Education System Model (MOSEIB, by its Spanish acronym), which includes aspects related to sustainable agriculture,

a topic within the institution's mesocurriculum. However, these topics are only loosely connected to classes specifically devoted to understanding climate change as an integral issue—that is, as a social, political, and economic problem.

It is important to note that the weekly time allocation for subjects related to environmental education or climate change ranges from two to six hours. Teachers at the Monte Sinaí and 29 de Julio schools devote only two hours, whereas in Quilloac six hours per week are assigned.

Local actors' perceptions of climate change

This section examines the perspectives held by local actors regarding climate change and its impacts on society, based on the responses they gave to each of the interview questions.

A) What have you heard about climate change?

Local actors associate climate change primarily with variations in temperature and connect it to transformations in water, in the mountains—where sacred beings who protect life, the apus, reside—in livestock practices, and in traditional food-related habits. In other words, they frame it within Category 4 and Category 6. They also express concern about the increase in health problems related to these changes. One testimony states: "We realized, as a society, that food is changing rapidly, just like the climate, and that this is notably affecting people and their households." (F. Pichisaca, personal communication, May 10, 2024).

Another aspect repeatedly mentioned across all the communities studied is migration, associated with Categories 4 and 5, which has altered the family unit, understood as a fundamental space for caring for the chakra and nature, and for sustaining cultural identity. According to this perspective, without family there can be no strong agriculture, no healthy food, and no guarantee that ancestral knowledge about how to plant, harvest, and care for animals will be transmitted to future generations.

B) In what part of your community do you think alterations caused by climate change have occurred?

Participants demonstrate a profound knowledge of the landscape, as well as a close relationship with the various natural and productive spaces that make up their communities. This bond is reflected in a detailed and sensitive perception of the changes that have occurred in their surroundings over time.

Repeatedly, they refer to the transformation of lagoons, the diversion or reduction of river flow, and the progressive deterioration of forested areas due to frequent burning, often associated with inappropriate land use. They also identify unusual climatic patterns, such as prolonged droughts and intense off-season rains, which directly affect agricultural activities, food security, and traditional cultivation cycles.

C) What local knowledge and practices for the care and management of natural elements are carried out in this community?

In the communities of Sígsigcocha and Chilcachapar, community leaders emphasize the importance of carrying out ongoing landscape reforestation processes, an activity that not only forms part of their traditional practices but has also been a recurring demand addressed to local authorities, especially parish board presidents. This action responds to the need to restore degraded ecosystems, conserve water sources, and mitigate the effects of climate change. In Chilcachapar, in addition to reforestation, the implementation of rainwater harvesting systems is highlighted as an adaptive strategy to address water scarcity. This practice has evolved into the use of storage tanks, allowing water to be stored for domestic and agricultural use.

> To sustain cultivation of the land, community labor is essential, and this is expressed through ayni. *Ayni* is a principle of Andean Indigenous philosophy related to caring for the relationships among human beings and between human beings and apus, sacred beings, plants, and animals—all with the aim of sustaining life in community. Ayni is the way in which agricultural tasks are shared and carried out collaboratively among community members, where one gives and receives, not as an obligation, but as part of an intensely lived practice that will later be returned by the same pacha. Another example of *ayni* occurs when the entire community works in minka to protect the life of all the elements of the allpamama (R. Alulema, personal communication, May 22, 2024).

For their part, the elders of the Quilloac community emphasize an agrocentric vision, understood as an ancestral practice of caring for and protecting the *allpa mama* (the maternal center from which everything originates): "When the *yaku mama* (water), the *inti tayta* (sun), the *killa mama* (moon), *sara mama* (corn), and the *apus* (mountain spirits) are contaminated or sick, they lose their balance for sustaining their own life and the life of the *allpa*" (F. Pichisaca, personal communication, May 10, 2024). Likewise, they stress that environmental care must be grounded in respect for ancestral knowledge, the use

Table 3
Description of the elements drawn by students from the Unidad Educativa Intercultural Bilingüe Monte Sinaí

Talking map of the Unidad Educativa Intercultural Bilingüe Monte Sinaí	No.	Name	Description
	1	Forests	Logging and burning of forests.
	2	Rivers, streams, and springs	Water contaminated by the presence of livestock.
	3	Livestock	Greater presence throughout the territory, affecting water sources.
	4	Plots of land and gardens	Family gardens provide healthy food, but there are very few in the community.
	5	Lake	Lake Sígsigcocha is drying up because of urban expansion. The community is called Sígsigcocha, and if the lagoon disappears, then it no longer makes sense for us to be called Sígsigcocha.

of the Andean agricultural calendar, and coordinated action among families, communities, and communal systems.

In addition, the political and collective dimension is another element they consider fundamental for environmental management. For them, protecting nature cannot be separated from community organization or from the autonomous decisions made in assemblies. From their perspective, political commitment to Mother Earth is expressed not only in productive practices but also in the ethical principles that guide communal life and the transmission of knowledge to younger generations. In this regard, Category 3 is evident across all community leaders.

Student representations of climate change

Tables 3, 4, and 5 present descriptions of the elements drawn by the students—whether natural or sociocultural—that, in their view, show alterations or changes.

Ultimately, the talking maps produced by students from the rural and intercultural bilingual educational institutions Monte Sinaí, 29 de Julio, and Quilloac

Table 4
Description of the elements drawn by students from the Escuela de Educación General Básica 29 de Julio

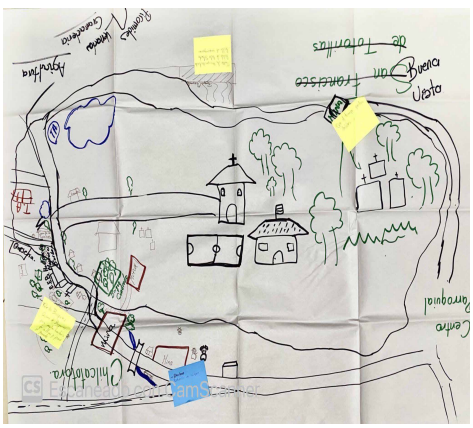
Talking map of the Escuela de Educación General Básica 29 de Julio	No.	Name	Description
	1	Forest	Logging and burning.
	2	Mine	Destruction and conflict.
	3	Cheese-making facility	A place where healthy, chemical-free cheese is produced.
	4	Agriculture	Limited agricultural activity in family gardens.
	5	Deer	They were heavily hunted just a few years ago, and now very few remain.

Table 5
Description of the elements drawn by students from the Unidad Educativa Intercultural Bilingüe Quilloac

Talking map of the Unidad Educativa Intercultural Bilingüe Quilloac	No.	Name	Description
	1	Lagoons, rivers, and water reservoirs	Droughts are becoming more prolonged.
	2	Forests (charcoal-producing area)	There are fewer and fewer forests.
	3	Hills and mountains	The elders say these are places where the apus live, but now people go to these hills (Narrío) for tourism.
	4	Chakras and school and family gardens	Places of learning within the educational unit; they are also spaces for work and learning with parents, grandparents, or other family members.
	5	Agricultural foods	Fewer and fewer families are engaged in agriculture because of migration and because pests are destroying crops.
	6	Processed foods	Processed foods are being consumed more and more both at school and at home.

reveal perceptions related to all the categories, with the exception of Category 3. In other words, they offer profound expressions of concern about the deterioration of their surroundings and even point to responses that underscore worries about issues such as migration and changes in food practices, which the students regard as closely linked to climate change.

DISCUSSION

Contrasts in teachers' understandings of climate change and their approaches to teaching it

In the Monte Sinaí and 29 de Julio educational institutions, teachers understand climate change as a physical phenomenon, and its treatment within the curriculum is limited and fragmented, largely confined to the natural sciences. In addition, they approach it in a technified manner, with emphasis on environmental effects. In practice, environmental education is taught exclusively through the TiNi methodology, centered on school gardens. Although these spaces constitute a valuable teaching-learning process for introducing basic knowledge of natural cycles and fostering values such as responsibility, respect for nature, and collective work, Freire (1993) argues that ecopedagogical reflection, or pedagogy of the Earth, remains disconnected from a deeper understanding of the structural problems linked to planetary degradation.

In this regard, the findings of this study are consistent with Vallejo Ronquillo (2022), who warns of a significant gap between official educational discourse and territorial realities, especially in campesino and Indigenous communities that experience the effects of climate change on a daily basis.

Even though these populations possess deep knowledge and adaptive practices built over generations, the national educational system, through its current pedagogical strategies, tends to rely on technoscientific approaches without incorporating participatory methodologies that promote shared responsibility, critical thinking, and, above all, recognition of local knowledge as a legitimate source of understanding (López Helgero & Aguirre Coello, 2025).

By contrast, at the Unidad Educativa Intercultural Bilingüe Quilloac, teachers develop a discourse that is both political and integrated into all dimensions of community life. This perspective is directly linked to the influence of Cañari social organizations, which have strengthened a collective political outlook grounded in agroecology, food sovereignty, and

respect for Pachamama. However, in classroom practice, these themes do not always reach the necessary level of depth and reflection, which may be related to the lack of strategies for addressing and assessing them. As Vallejo Ronquillo (2022) notes, there are institutional limitations in providing the pedagogical and didactic resources needed to guide a critical teaching-learning process.

Gudynas (2016) argues that recognizing the political and communal character of caring for the land highlights a critical dimension that is rarely emphasized in discourses on climate change. For these communities, protecting nature is inseparable from autonomous organization, assembly-based decision-making, and the defense of territory against external threats. In this sense, as López Helgero and Aguirre Coello (2025) point out, environmental education cannot be reduced to the transmission of technical knowledge; rather, it must strengthen young people's ethical and political commitment to their environment and their culture.

Local actors' voices in the face of climate change

The Indigenous and campesino peoples interviewed in this study possess a profound knowledge of the natural environment, which helps them adapt to climate change (Veloz Vera, 2022). This traditional knowledge—agrocentric in nature—includes elements such as the experiential agricultural calendar, the care of the chakra, and the intangible heritage associated with nature. These are essential for recovering historical knowledge and developing effective strategies to cope with the effects of climate change, which, according to Morote Seguido et al. (2025), plays an important role in survival under difficult conditions, such as forest burning, deforestation, and periods of drought.

The population studied, particularly the local elders, understands nature not merely as a resource, but as a fundamental component of their cultural identity and worldview. One important finding of this research is that climate change, by transforming or destroying rivers, mountains, lagoons, and sacred sites, directly affects the collective memory and cultural heritage of these peoples, since many of these places give rise to local place names, explain the foundational stories of the community, and are also spaces inhabited by sacred spirits such as the apus. This coincides with Royo Letelier's (2023) argument that environmental degradation entails not only an ecological crisis, but also a symbolic and cultural rupture that weakens the identity of Indigenous peoples.

The collective testimony of local actors and community elders recognizes life and nature as a cyclical process—that is, one in which the effects of climate change had already existed previously. Even so, they strongly emphasize not only environmental effects—such as droughts, temperature changes, and the degradation of water sources and forests—but also their links to changes in food habits, health, and family structure.

Finally, one particularly relevant aspect is the way local actors and community elders connect migration with the weakening of agriculture and ancestral knowledge. Migration not only alters the local economy, but also directly affects cultural reproduction and the community fabric needed to sustain family farming, work in the chakra, and the intergenerational transmission of knowledge. Thus, the statement that "without family there is no agriculture or healthy food" (N. Cepeda, personal communication, April 11, 2024) reveals a profound understanding of the interdependence among culture, nature, and community.

Water, territory, and food: students' representations of climate change

In the educational institutions of the province of Azuay, interpretations of climate change focus mainly on its direct impacts on nature, without delving into the broader political and structural dimensions that give rise to it. Even so, students from both institutions expressed concern about the loss of natural elements, noting that such transformations also imply damage to cultural identity, as in the case of the possible disappearance of the lagoon in Sígsigcocha.

These findings reflect the development of an initial environmental awareness, grounded in tangible experiences. Accordingly, studies by Gudynas (1998, 2016), Morin (2004), and Escalante Vélez (2024) suggest that, in the present context, formal education still needs to be strengthened through educational processes that promote a more critical, contextualized, and systemic analysis of climate change and its socio-environmental implications.

On the other hand, at the Unidad Educativa Intercultural Bilingüe Quilloac, students show an understanding of ecological change that is connected to migration and to changes in food practices. They also refer to the chakra as a space of intergenerational learning and incorporate a cultural dimension when they speak of narratives involving the apus.

This perspective among Indigenous and campesino youth, by linking the physical, human, and cultural

dimensions of climate change, is a sign of both natural and cultural resilience (Van Uffelen et al., 2022), as well as an important foundation for the development of situated environmental education strategies.

By way of conclusion, it is important to emphasize that one of the main strengths of this research lies in the inclusion of multiple perspectives, which makes possible a situated and experiential approach that enriches the interpretation of the findings and strengthens the connection between school and community. Nevertheless, one of the study's principal limitations is the uneven participation of teachers and students across the educational institutions analyzed, since Tarqui and Santa Ana had a smaller number of participants compared with the Unidad Educativa Intercultural Bilingüe Quilloac, which may have affected the depth and balance of the analysis.

Lastly, it is worth emphasizing that climate change is recognized as a relevant issue by teachers, students, and community leaders alike. However, there remains a need to move beyond reductionist views that address this problem solely from the perspective of the natural sciences. In this respect, it is essential to promote an interdisciplinary approach in formal education—one that recognizes climate change as not only an environmental issue, but also a political and communal phenomenon, and that actively incorporates the social sciences into its analysis and teaching.

CONCLUSIONS

The study reveals two distinct ways of approaching climate change in rural and intercultural bilingual schools. In the Unidad Educativa Intercultural Bilingüe Monte Sinaí and the Escuela de Educación General Básica 29 de Julio, it is understood primarily as a physical and technified phenomenon, limited to the field of natural sciences. In contrast, at the Unidad Educativa Intercultural Bilingüe Quilloac, a more comprehensive and culturally situated vision is developed, linked to community practices such as agroecology, care of the chakra, and the defense of Pachamama. Within this framework, teachers and students from Monte Sinaí, 29 de Julio, and Quilloac recognize climate change not only as an environmental disturbance, but also as a threat to the cultural, spiritual, and identity-based ties that sustain community life.

Community elders and local actors maintain a cyclical view of nature, yet they warn that migration, the loss of agricultural practices, and changes in food habits are weakening family farming and the intergenerational transmission of knowledge, a concern encapsulated in the phrase "without family there is no agriculture or healthy food." At the same time, the research shows that climate change, by transforming or destroying rivers, mountains, lagoons, and sacred sites, directly affects collective memory and cultural heritage, since these spaces—linked to foundational stories and geographical names—are essential to the symbolic construction of territory.

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Conflict of interest statement

The authors declare that they have no conflicts of interest.

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