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ETHNOPEDOGEOMORPHOLOGY IN A HUMID SECTOR OF THE EASTERN ESCARPMENT OF THE BORBOREMA HIGHLANDS: AN INTEGRATED LANDSCAPE ANALYSIS FROM THE VIEWPOINTS OF TRADITIONAL COMMUNITIES

ETNOPEDOGEOMORFOLOGIA EM UM SETOR DA ESCARPA ORIENTAL ÚMIDA DO PLANALTO DA BORBOREMA: UMA ANÁLISE INTEGRADA DA PAISAGEM A PARTIR DOS OLHARES DE COMUNIDADES TRADICIONAIS

ETNOPEDOGEOMORFOLOGÍA EN UN SECTOR DE LA ESCARPA HÚMEDA ORIENTAL DE LA MESETA DE BORBOREMA: UN ANÁLISIS INTEGRADO DEL PAISAJE DESDE LA PERSPECTIVA DE LAS COMUNIDADES TRADICIONALES

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ABSTRACT
The study proposes a concept of ethnopedogeomorphology and analyzes how rural communities classify soil types, surface processes, and landforms. The study area comprises two communities in Vicência/PE, between Piemonte and the eastern escarpment of the Borborema Highlands. The research adopted an ethnoscience approach, proposing a notion of ethnopedogeomorphology: how traditional knowledge associates soil and relief in agropastoral activities. The methodology followed a routine of fieldwork, application of interviews, identification of geomorphic elements, and cartography. Traditional communities' classification and the general understanding of soil classes and landforms reflect academic knowledge. The nomenclatures used between communities did not show significant differences due to geographical proximity.
Palavras-chave: Ethnoscience. Pedogeomorphology. Northeast Brazil.

RESUMO
O estudo propõe um conceito de etnopedogeomorfologia, e analisa como comunidades rurais classificam tipos de solo, processos superficiais e formas de relevo. A área de estudo compreende duas comunidades do município de Vicência/PE, situadas entre o Piemonte e a escarpa oriental do Planalto da Borborema. A pesquisa adotou o enfoque da etno-ciência, propondo uma noção de etnopedogeomorfologia, ou seja, como o conhecimento tradicional associa solo e relevo nas atividades agropastoris. A metodologia seguiu uma rotina de trabalhos de campo, aplicação de entrevistas, identificação de elementos geomórficos e cartografia. A classificação e os entendimento geral das comunidades tradicionais acerca das classes de solos e formas do relevo espelham o conhecimento acadêmico. As nomenclaturas utilizadas entre as comunidades não apresentaram diferenças significativas devido à proximidade geográfica.
Palavras-chave: Etnociências. Pedogeomorfologia. Nordeste Brasileiro.

RESUMEN
El estudio propone un concepto de etnopedogeomorfología y analiza cómo comunidades rurales clasifican suelos, procesos superficiales y formas del relieve. El área de estudio comprende dos comunidades ubicadas entre el Piemonte y el escarpe oriental de la meseta de Borborema. La investigación adoptó un enfoque etnocientífico, proponiendo una noción de etnopedogeomorfología, o sea, cómo saberes tradicionales asocian suelo y relieve en actividades agropastorales. La metodología siguió una rutina de trabajo de campo, aplicación de entrevistas, identificación de elementos geomórficos y cartografía. La clasificación y comprensión general de las comunidades tradicionales sobre clases de suelo y formas del relieve

reflejan el conocimiento académico. Las nomenclaturas utilizadas entre comunidades no mostraron diferencias significativas debido a la proximidad geográfica.

Palavras-chave: Etnociencia. Pedo-Geomorfología. Nordeste De Brasil.

INTRODUCTION

Bringing up traditional knowledge in the face of the physical-natural ladscape attributes is a kind of appreciation of ways of life and cultural resistance, often disregarded by academia and other public entities and corporations. The Northeast region of Brazil presents a very peculiar and unique set of physical and cultural aspects. The area extends from the humid coast to the semi-arid interior. Its physical landscapes and surface processes give rise to quite specific nomenclatures, both on a regional and local scale, aimed at describing landforms, soils, and land use typologies. These reflect cultural choices and the territorial formation history of traditional rural populations.

The study area is located in the humid tropical sector of the east facade of Pernambuco. Geomorphologically, it lies at the intersection between two regional morphostructures, the Borborema Plateau and its Piemonte. Consequently, the landforms are notably dissected, alternating the eastern escarpment sector of the Borborema Highlands, the convex hills of its Piedmont, terraces, and alluvial plains. Displaying a rainy tropical climate with a dry summer dominated by the southeast trade winds (CPRM, 2005), this area's territorial formation has been described as a "stage of multiple scenarios where a vibrant reality is expressed" around the individual's perceptions of the environment (GRABOIS *et al.*, 1992).

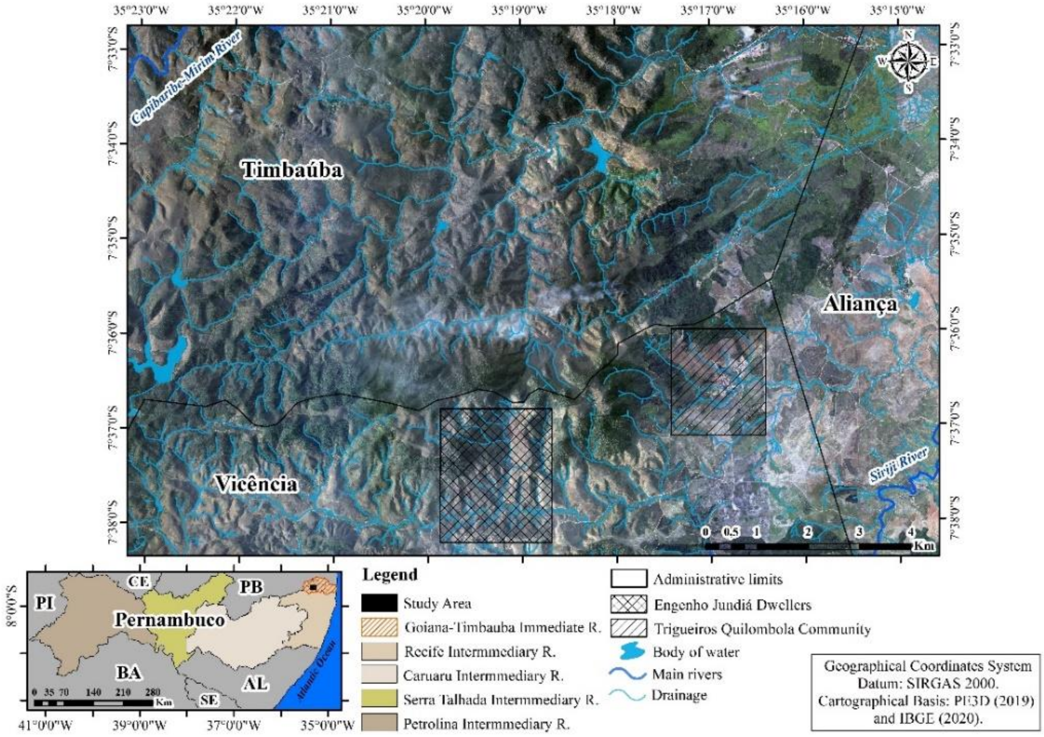
Geologically, the research area is located in the easternmost corner of the Borborema Province, north of the Pernambuco shear zone and south of the Patos shear zone. The landscape encompasses lithologies correlated to Paleo- and Meso-Proterozoic metamorphic complexes and Neoproterozoic plutonic intrusions (SILVA, 2012; GONÇALVES, 2018).

According to the new Regional Division of Brazil (IBGE, 2017), the area is inserted in the Immediate Region of Goiana–Timbaúba and the Intermediate Region of Recife, between the municipalities of Vicência, Timbaúba, and Aliança. Due to its environmental peculiarities and the diversity of traditional knowledge of its inhabitants in the face of the pedological and geomorphological contexts, the study emphasized two communities with distinct characteristics, the dwellers of Engenho Jundiá and the Quilombola Community of Trigueiros, both in the municipality of Vicência (Figure 1).

The area where the studied communities are located is dissected by two rivers that belong to the Goiana River watershed (SEMAS, 2014), the Capibaribe Mirim to the northwest and the Sirijí and its tributaries to the southeast. These drainages, especially the Sirijí River, are relevant to the history of territorial formation with the scenarios of land use associated with the cultivation of sugarcane, a commodity still essential to the region's economy (ANDRADE, 1971).

Due to its environmental peculiarities, on the border between two morphostructural compartments with different morphological and morphometric characteristics, it is assumed that the rural communities in the area share a diversity of traditional knowledge regarding its physiographic aspects. Thus, bringing up the theme of ethnopedogeomorphology aimed at rescuing and recognizing the know-how related to land use practices and management as they relate to the surface processes and operating on local landforms.

Figure 1. Study area and local communities



Source: Authors (2022).

Following the above, this work proposes an applied and innovative contribution of ethnoscience to the region, initially proposing an operational definition of ethnopedogeomorphology. Based on this understanding, the next stage constitutes an analysis of the expressions and perceptions historically constructed by the communities of Residents of Engenho Jundiá and the Quilombola Community of Trigueiros, based on the way they classify and name soil types, surface morphogenetic processes, and the landforms on which agropastoral activities are carried out.

THEORETICAL-CONCEPTUAL APPROACH

Ethnopedogeomorphology as an emerging branch of ethnoecology

With an anthropological origin, this new branch of geosciences arises from the perspective of trying to understand the elements and phenomena inserted in the physical landscape through the analysis of the taxonomies adopted by traditional rural groups, which highlight the pedological typologies, the morphodynamic processes and the geoforms that are familiar to them from land use and management practices.

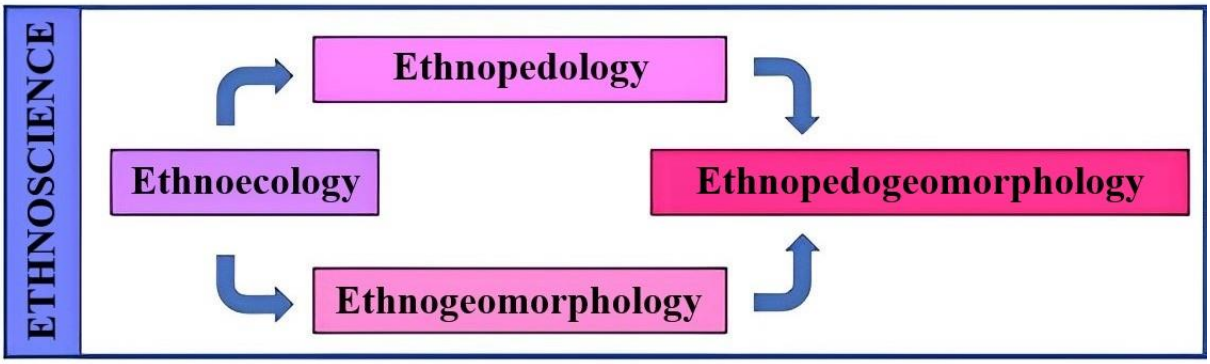
Ethnopedogeomorphology is based on understanding the environmental perception of rural workers, focused on the logic of peasant agriculture. The rationale behind this idea comes from ethnoecology and the notion that local knowledge is part of traditional wisdom and constitutes a true intellectual and practical archive of how societies adapt to the physical and natural environments in which they live. From this analysis, various interpretations emerge that reflect the complex of beliefs (kosmos), knowledge (corpus), and practices (praxis) in the form of a cyclical and dynamic system (k-c-p complex) aiming at natural processes (TOLEDO E BARRERA-BASSOLS, 2009; LOPES AND RIBEIRO, 2013; LOPES *et al.*, 2021).

From another perspective, ethnopedology as part of ethnoecology encompasses all experience systems of soil (land) knowledge by rural populations, correlating the role of the soil with the management of natural resources based on comparative methods. Most of the studies in this perspective aim to identify similarities and differences between local and academic knowledge. Studies of this category attribute possible correlations between different soils and classification systems based on management and daily land use (BARRERA-BASSOLS AND ZINCK, 2003). By adding the geomorphic variable, ethnogeomorphology can be understood as "the knowledge that a community has about the geomorphological processes, taking into account the knowledge about the nature and values of the local culture and tradition, being the anthropological basis for the use of the landforms for a given culture" (RIBEIRO, 2012, p. 49).

Based on a social and systemic analysis of the landscape centered on the farmer's integrated perception of the pedogeomorphological classifications, it is observed that these are expressed through a range of complex attributions regarding the role of soil use and management over time. Thus, as a result of the experience passed on by generations, knowledge is mainly accumulated about the surface cover of the landscape, as well as the soil x relief relationship, which end up converging in the form of taxonomies of high practical value and use for the peasants.

According to this point of view, ethnopedogeomorphology is a branch of ethnosciences that studies and classifies soil elements and properties in a hybrid way. The typologies emerge from the practices of traditional groups of farmers, their experiences with land use and management, and the way they perceive and name the morphodynamic processes and landforms that make up the scenario of their living experience (Figure 2).

Figure 2. Etnopedogeomorphological approach



Source: Authors (2022).

Ethnopedogeomorphology interacts directly with the pedological elements of the landscape, as it is from them that the morphodynamic elements are expressed. On the other hand, the soil is simultaneously the element for human sustenance through food production and a source of collective knowledge since aspects related to its use and conservation are passed on to descendants, with the main focus on mitigating degradation processes.

METHODOLOGY

Literature review and cartographic production

In order to implement the conception of a humanistic or social geomorphology, it is necessary to rescue the notion of place, as discussed by Tuan (1983), through a

phenomenological approach. In this regard, Gil (2008) proposes that "we seek to clarify what is given" to rescue the residents' experience. On the other hand, for the analysis of the physical landscape, a geosystemic approach is used, as discussed by Bertrand (2007), which promotes a methodology based on a triad of essentially geographic elements, which incorporates the physical-natural elements together with anthropic ones, synthesized by the acronym GTP (Geosystem-Territory-Landscape).

Cartographic products were built using ArcGIS software in version 10.3. The processing of orthophotos and the creation of the Digital Terrain Model - DTM, were carried out from the files made available by the Pernambuco Tridimensional - PE3D portal. The images have a spatial resolution of 1-meter, geographic coordinate system, transverse Mercator, and Datum SIRGAS 2000 UTM Zone 25 S projection. Semi-detail maps were produced on a scale of 1:90,000, aiming at providing better visualization and understanding of spatial attributes, such as the location of the study area and the ethnopedogeomorphological map. For the pedological coverage, a detailed scale of 1:20,000 was chosen, as proposed by PALMIERI AND LARACH (2017).

The construction of the ethnopedogeomorphological map followed the guidelines proposed by the Manual of the International Geographical Union for semi-detail geomorphological mapping (Demek, 1972) for the identification of morphologies and surface coverings. In addition, the adopted nomenclature followed the applications presented by Corrêa (1997) and LIMA *et al.* (2015) for Northeast Brazil.

One of the problems faced in mapping was the degree of detail, and the scale (CASTRO, 1995) of the various facts portrayed. Therefore, in making the pedological map, a shapefile was used on the 1:100,000 scale of the Brazilian Agricultural Research Corporation (EMBRAPA) and its classification (EMBRAPA, 2018). However, to better discuss the pedological knowledge of the analyzed communities, it was decided to use the pedological database provided by the Pernambuco Agronomic Institute (IPA) on a scale of 1:25,000 for the municipality of Vicência as part of the Pilot Project PROMATA (IPA PROMATA, 2001). In this way, it was possible to attribute the appropriate level of pedological detail to the study of the community of dwellers of Engenho Jundiá and the Quilombola Community of Trigueiros (PALMIERI AND LARACH, 2017).

The Global Mapper 21.0 software was used to generate the topographic transects, whereas the color edition was carried out in Paint 3D, available in Windows 10 package. For all maps, a transparency level of 30% of the shapefile was applied, overlapping the shaded relief, thus highlighting the relief patterns visible in the landscape.

Development of interviews' questionaries and data analysis

For the development of interviews and in situ activities with community members, a methodological sampling technique known as "snowball" was used, also defined as snowball sampling (BIERNACKI AND WALDORF, 1981). This method, applied in sociology and population statistics, seeks to enlist the support of key individuals within a group, in this case, people with decision-making power and leadership. From the first contact with the key individuals within the community, it is expected to access new respondents, thus breaking the initial resistance characteristic of hermetic social groups. Finally, as the sample grows, the data become relevant to the point of allowing a more realistic recomposition of the studied scenario. According to the approach, the sampling saturation level is reached as the information/answers provided by the interviewees reach a level of common knowledge in terms of taxonomic content and understanding of the phenomena. This stage is reached when respondents say the same about a specific content (RIBEIRO, 2012; VINUTO, 2014).

A sample of 50 respondents in each community was considered for data tabulation and analysis. Although most of the questionnaire respondents were illiterate or with only incomplete primary education, they demonstrated life experience and accumulated knowledge necessary for the research. Interviews organization and application were based on a model developed by Ribeiro (2012) for a rural context in the semi-arid region of Ceará State. Thus, the questionnaires were built in a semi-structured way from pre-written scripts. After gathering the interviewees' general data, a sequence of questions followed, such as: what name do they give to the type of soil (earth)? What are the differences between the types? Where do they occur in the landscape? What is the best soil (earth) for agriculture? How do they occur, and where are they found in the landscape? What names do they use for different types of erosion and mass movements? What is the difference between these processes? What types of landforms and erosion occur in the area? Where are they located? How can they describe them? What use is made of these forms?

The interviews were recorded in digital media, and according to the responses obtained, a photographic collection was created showing the morphodynamic forms and processes described by the respondents. Landforms were associated with identified soil types. In line with Lopes' (2017) proposal to maintain the research's integrity, the interviewees' names were not used in the analyses, only gender, age, and community of origin.

RESULTS AND DISCUSSION

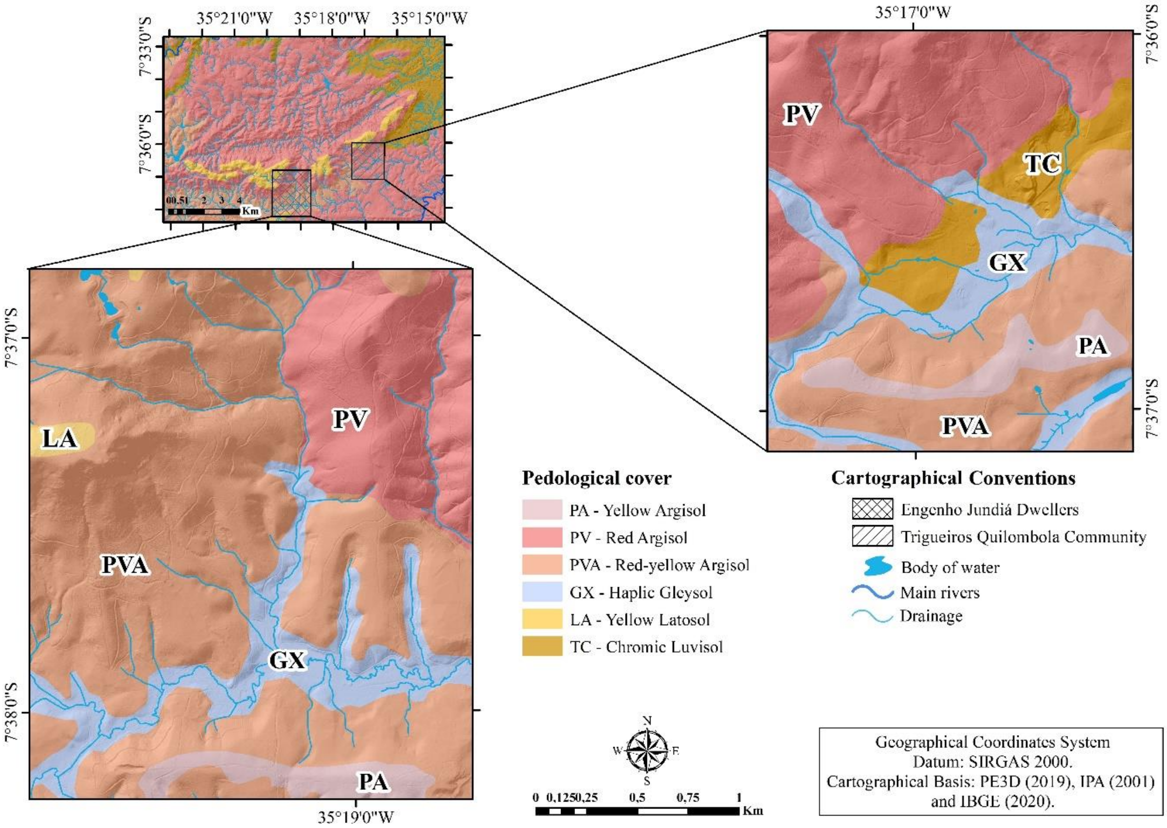
Pedological characterization

Due to the research being focused on ethnopedogeomorphological studies, it was necessary to prepare a detailed soil map for the analyzed communities (PALMIERI AND LARACH, 2017). From the detailing of the distribution of the spatial phenomena studied (CASTRO, 1995), it was possible to generate more precise syntheses between the cartographic material and the interviewees' statements. On this scale of analysis, the soil classes that occur in the area are yellow argisol (PA), red argisol (PV), red-yellow argisol (PVA), haplic gleysol (GX), yellow latosol (LA), and chromic luvisol (TC) (Figure 3).

When soil is associated with the landscape, aspects related to the drainage network, climate action, organisms, geology (parental material), and relief are relevant to understanding the pedological distribution. The sum of these aspects over time results in the history of soil formation and distribution over the landscape, in addition to understanding land occupation and use processes (LEPSCH, 2010; PALMIERI AND LARACH, 2017; GONÇALVES, 2018).

The study area has very dissected surfaces due to the correlation between current and past climatic and morphotectonic factors. The long-term evolutionary history of the landscape has resulted in the deepening of regoliths and overlapping soils. The "stone lines" within the profiles represent old buried detrital pavements. These are visible along cuts at the bases of hillslopes (AB'SÁBER, 2003; PORTO, 2017). Due to its small extension, the studied area does not present many pedological classes.

Figure 3. Detailed pedological map of the studied communities



Source: Authors (2022).

Concerning latosols, the parental material is quite weathered, corresponding morphologically to significantly evolved profiles ranging from deep to very deep (FONSÊCA, 2018). The patches of this class are associated with the highest relief levels (Figure 3) along summit surfaces. These soils consist of a very thick B horizon occurring below any A horizon. They are characterized by high porosity, good drainage – intense leaching – and friable consistency, with little differentiation between the horizons (LEPSCH, 2010; PORTO, 2017; EMBRAPA, 2018; FONSÊCA, 2018). Thus, the patches of yellow latosols (LA), according to Embrapa (2018) are “soils with a 7.5YR or more yellow hue in most of the first 100 cm of the B horizon”.

The argisols are distributed over sectors of significant geological variability (FONSÊCA, 2018), crossed by the Sirijí River and its tributaries to the southeast. Despite being very weathered, compared to latosols, argisols show marked differentiation between the horizons in the profile sequences A Bt and C or A, E, Bt, and C, due to the accumulation of clays in the Bt horizon (LEPSCH, 2010; PALMIERI AND LARACH, 2017). Thus, according to Embrapa (2018) red acrissols are “soils with a 2.5YR hue or more red in most of the first 100 cm of the B horizon (including BA)”. The red-yellow argisols are “other soils with red-yellow and/or yellow-red colors that do not fit into the previous classes” (EMBRAPA, 2018).

The luvisols are located on the metamorphic rocks of the Salgadinho Complex (PP2sg) and Vertentes Complex (PP2ve), with greater preponderance in the northeast of the area and minor occurrences in the northwest, crossed by the Capibaribe Mirim river. This pedological class is associated with gently undulating relief surfaces due to dissection (FONSÊCA, 2018).

These soils are characterized by being little or moderately weathered, with an accumulation of highly active clays, rich in exchangeable bases, in the Bt horizon (LEPSCH, 2010; EMBRAPA, 2018). Luvisols are not as deep or chemically evolved as argisols and tend to have a lot of surface stoniness (FONSÊCA, 2018).

In the study area, gleysols occur restricted to the lowered sectors, which are periodically or permanently saturated by water. Its texture varies from clayey, clayey-sandy to sandy. The reducing environment implies the development of grayish, bluish, or greenish color patterns, typical of the reduction and solubilization of iron. These soils have a gley horizon located in the first 150 cm, under a thin A (mineral) or H (organic) horizon (LEPSCH, 2010; EMBRAPA, 2018). The haplic gleysols stand out as floodplain soils, affected by water table oscillations and redox processes that generate small ferruginous concretions called mottling, with yellowish and reddish tones (PALMIERI AND LARACH, 2017; EMBRAPA, 2018).

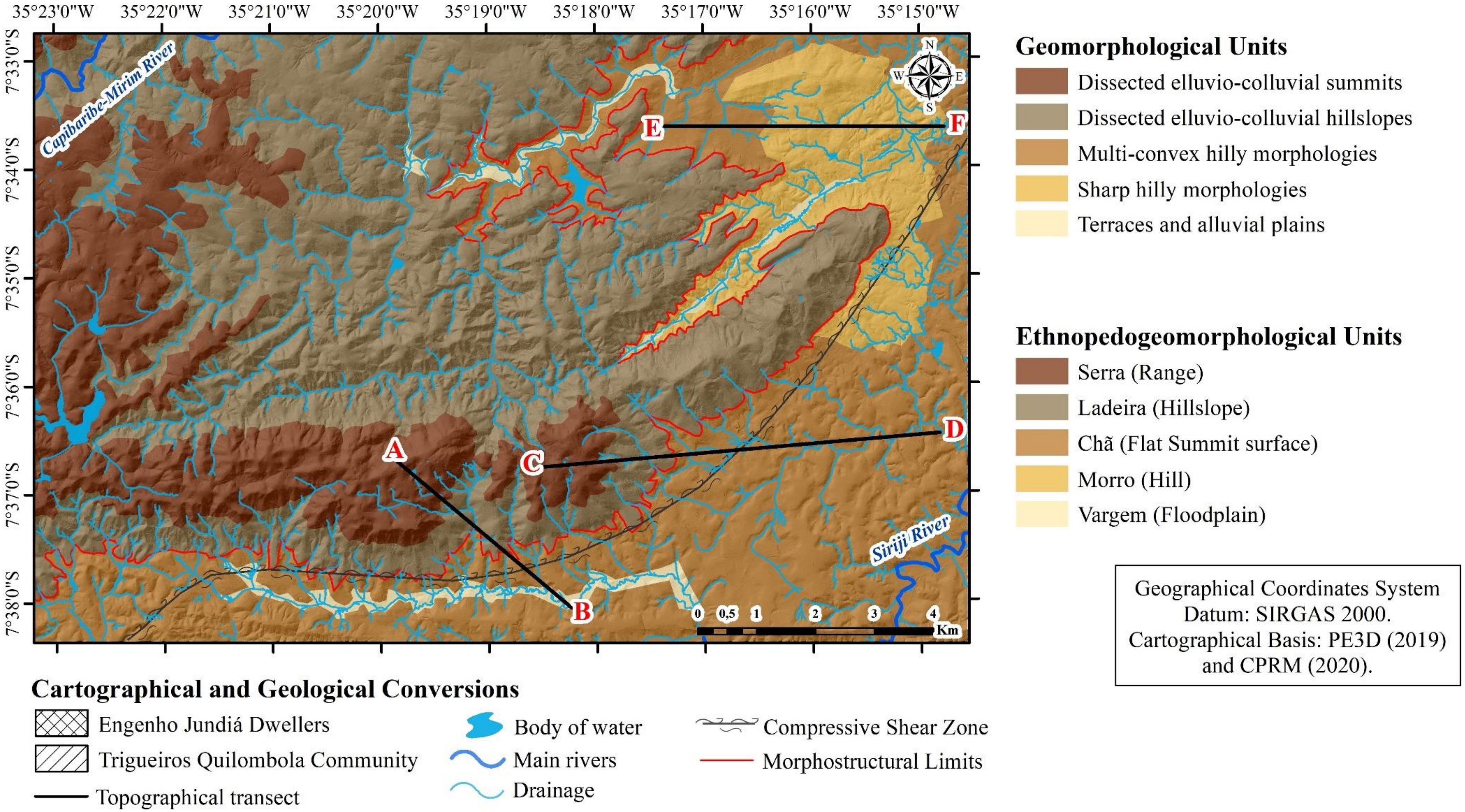
Ethnopedogeomorphological classification

The ethnopedogeomorphological knowledge identified through direct consultation with small rural producers from both communities studied in the eastern sector of the Borborema Highlands's escarpment was generally similar concerning the relief units and the types of soil and surface dynamic processes of the landscape. Hence, the taxonomic classifications shown in charts 1 and 2 show no significant differences regarding the typologies adopted by the two rural groups.

Dealing with morphological units, the producers define the landforms by the topography/altimetry of the relief (geomorphic unit) and their morphology on a smaller scale (morphological units). In general, five basic ethnogeomorphological units were identified, namely: “Serra” (range), “Ladeira” (hillslope), “Chã” (flat summit or divide), “Morros” (hills), and “Vargem” (floodplain), as shown in the topographic profiles A-B, C-D, E-F and in figures 4 and 5.

For the eluvial-colluvial Summits, generally dissected and covering several catchments in the form of confined topographic hollows, the denomination of “Serra” (range) is shared among the majority of the interviewees. This terminology refers to the highest sectors of the landscape, with altimetric elevated summit levels bordered by steep slopes that stand out in the landscape (Figures 4 and 5). This taxonomic employment is similar to that recorded by Ribeiro (2012) in the Cariri region in the south of Ceará state under semi-arid conditions. Some interviewees also classified these places as “Lugar alto” (high place) (Chart 2). This landscape unit is a legacy of differential erosion and the action of long-term denudational processes acting on the eastern margin of the Borborema Province. This ethnogeomorphological unit presents laminar erosion at the tops and linear erosion at specific points around slope breaks where processes of drainage headwaters incision are triggered. The prevailing type of erosion is also directly associated with the type of land use.

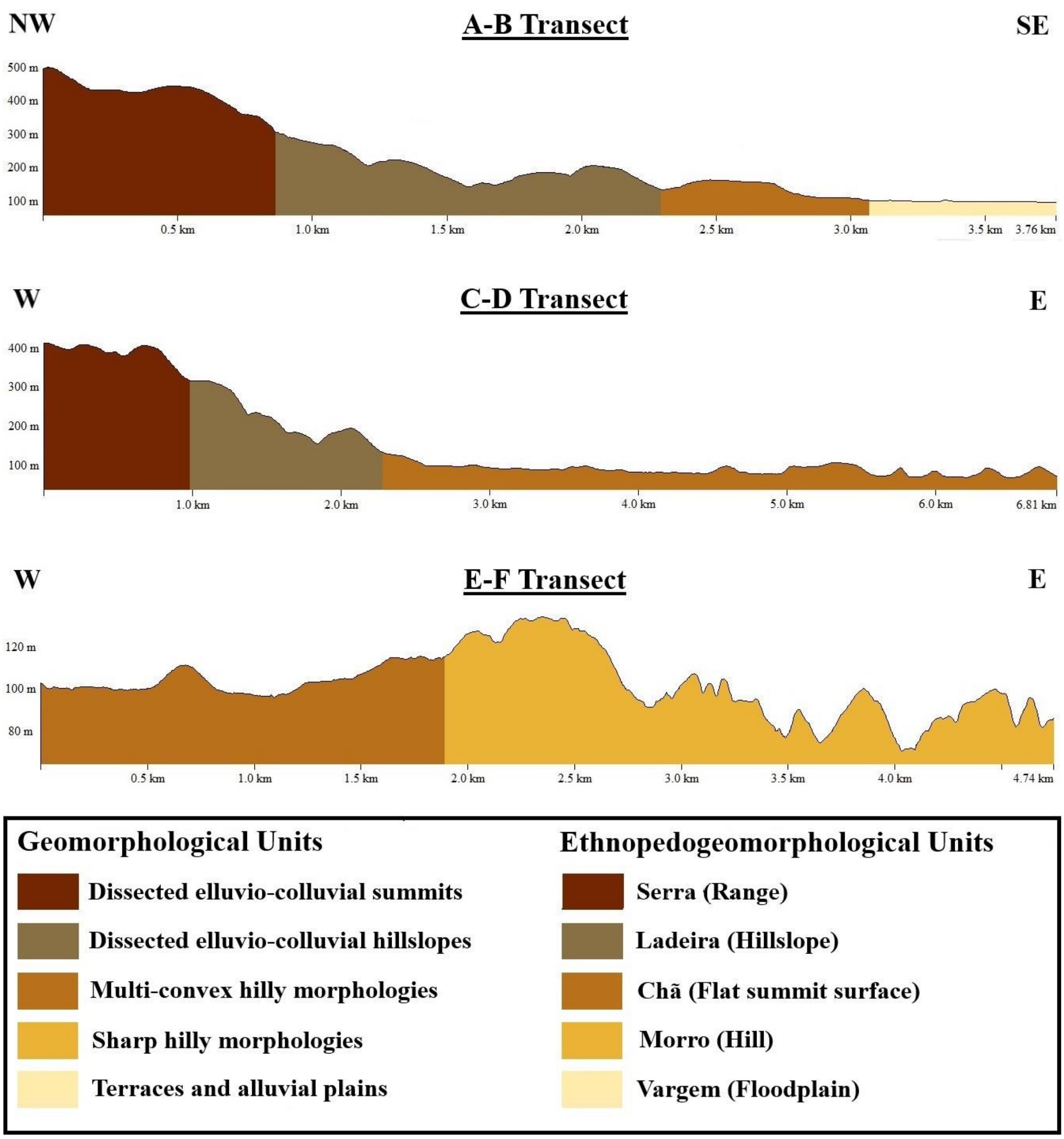
Figure 4. Geomorphological and ethnopedogeomorphological compartments and topographical transects



Source: Authors (2022).

The Dissected elluvio-colluvial hillslopes unit surrounds the entire “Serra” (range). The classification used by the interviewees for this unit, “Ladeira” (hillslope) or “Ladeirão” (steep hillslope), provides the hillslope morphology with a slope gradient modulator, which varies from accentuated to moderate (Figures 4 and 5). In these steep sectors, the presence of drainage catchments is ubiquitous. These headwater zones are called “Coigo” (stream), which for the interviewees, correspond to the drainage headwaters with confined valleys with a “V” shape in a transverse transect. They are areas of convergence of watercourses in the rainy season, located on the middle and lower hillslope segments. In general, they present a deposition of eluvial-colluvial sediments converging from the hillsides to the local base levels that fill up the valley bottoms giving rise to narrow stretches of alluvial plains and terraces.

Figure 5. Topographical transect



Source: Authors (2022).

Along the "Ladeiras" (hillslopes), the occurrence of topographic knicks should be highlighted. They constitute slope breaks on the surface of the landform. On the stream beds, the ruptures of gradient occur as knickpoints that originate rapids and small waterfalls locally called "bica/bicas" (torrent). Farmers build small dams over rocky sills in these stretches to collect water for irrigation systems. These are very common in banana-growing areas close to Engenho Jundiá.

In this environment, creeping is pervasive, with bananas and other trees leaning sideways. By their turn, rock falls are more noticeable in pasture areas, especially under Red Argisols (PV) and Red-Yellow Argisols (PVA) covers, as represented in the pedological (Figure 3).

The Multi-convex hilly morphologies are identified by local farmers based on the morphology of their tops, with a level or gently rolling appearance, which corresponds to the nomenclature of “Chã” (flat summit) or “Lombadas” (rump-back summit).). This unit is characterized by very dissected reliefs with gentle convex shapes, possibly leading to the designation of “Lombada” (rump-back). The “Morros” correspond to hills with hillslopes of moderate gradients and sharp morphology tops. This local classification refers to the sharp hilly morphologies with more incised valleys controlled by the geological structures than the other units.

Based on the observation of the hilly units landscape, the producers realize that soil-creep evidence is more evident in areas under pasture, mainly in the "Ladeiras" (hillslopes) and "Chãs" (flat-summits). Moreover, in addition to sharing the same typology of use, these taxonomic units have a more developed and deeper pedological coverage. The morphological result of this slow process, the terracettes are designated by the locals as "Caminhos de boi" (oxen tracks).

In the communities, the translational slides are described by the expression “desceu a barreira” (lit., the hillside has come down). Rock falls and other toppling phenomena are often designated by “o barranco desmoronou” (lit., the hillside has toppled). As shown in Chart 1, translational slides are more prevalent; however, in this case, a lack of consensus among interviewers regarding the use of both terminologies was verified. Regarding rock falls, although the processes and their derived deposits are observed in the area, it was verified that the local population tends to address them with the same terminology as for the translational slides “desceu a barreira”. However, sometimes they use the more specific and descriptively accurate designation “o barranco desmoronou” interchangeably.

As for erosive phenomena, it was observed that sheet-flow plays a minor role in the area, thus not causing any significant damage to agriculture. Some farmers refer to it as “lama” (mud), but others do not apply any particular term or do not recognize the process. Nonetheless, when inquired about linear processes, such as rills and gullies, conspicuously visible in the landscape, most respondents reported their occurrence on “Ladeiras” (hillslope), “Chã (flat summit hills) and “Morros” (sharp summit hills). These areas are referred to as “decidos” (low-lying sites) (Woman, 45 y/o, Engenho Jundiá).

Chart 1. Morphodynamic processes in the vicinity of the studied communities and their correlated designation

Morphodynamic Process	Engenho Jundiá dwellers	Trigueiro Quilombola Community
Rill	*Valeta, rego*	Valeta
Gully	*Cratera, buraco, valeta funda, valada*	*Cratera, buraco, grota, vala, "quase um riacho"* (lit., almost a creek)
Creep (Terracettes)	*Caminho do boi* (oxen tracks)	*Caminho do boi* (oxen tracks)
Slides	*Desceu a barreira* (lit., the hillside has come down), *A barreira desmoronou* (lit., the hillside has toppled)	*Desceu a barreira* (lit., the hillside has come down), *Arriou a terra* (lit. earth has come down)
Rock fall	*O barranco desmoronou,* (lit., the hillside has toppled) *Rocha embolada* (lit. rolled rock)	*Desmoronamento* (toppling), *arriou a pedra* (lit., the rock has come down)

Source: Authors (2022).

Locally rills are called "valeta" or "rego" (Chart 1). However, according to their residence time in the landscape - which depends on land use type, rainfall events, and the size of the erosive scars – when reaching the gully scale, these forms are known as "cratera" (crater) and "buraco"(hole).

It became clear that the names given to the erosive features vary according to their size and time of residence in the landscape; thus, gullies will be addressed either as "cratera" (crater) or "buraco" (hole). These two denominations are prevalent, but other forms have also been recorded, such as "valeta funda" (lit., deep ravine), "vala" (ravine), "valada," "grota"(grotto), and, if the erosive incision reaches the water table some may describe the feature as "quase um riacho" (lit., almost a creek) (Woman, 62 y/o, Trigueiros Quilombola Community). A 72 y/o male interviewee from the Trigueiros Quilombola Community, concerning the trigger mechanism behind gully erosion, said, "a erosão acontece, porque são áreas descampadas e desniveladas" (lit., the erosion happens because the areas are cleared and left uneven). Most respondents associated intense linear erosion with steep and topographically uneven landscape sectors.

The alluvial plains and terraces are termed "Vargem" (floodplain), "Vazante" (flow), "Lugar baixo" (lit. low-lying place), or "Baixada" (lowland) (Figures 4 and 5). These correspond to the lower sectors of the landscape dominated by fluvial deposition along the main drainage channels. The sediments present a clayey to sandy-clayey texture with a high organic component. These areas of haplic gleysols occurrence remain soggy most of the year.

At these lower elevations, during the rainfall season, the run-off is channeled towards the valley bottoms resulting in flooding and crop losses. During the dry season, however, these areas are used for dry farming of short-cycle crops and vegetables. The respondents identify these areas as being notably fertile.

In ethnopedological terms, the communities classify the surface horizons with organic matter and darker hues as "Terra Preta." This nomenclature is generally associated with the O horizon, where short-cycle crops are grown, especially on haplic gleysols of dark grey and greyish colors. Due to the high clay content, the farmers from Trigueiro Quilombola Community name these soils “massapê.” In their case, most of the traditional farming settlement lies in this soil category, unlike the Engenho Jundiá Community, where settlers are distributed over various soil types and landscape sectors.

Red and red-yellow argisols are well distributed over the surfaces surrounding the Borborema Highlands, thus accounting for more than half of the soil cover of the study area. Due to their color, displaying different hues of red according to the content of iron oxides, all respondents refer to those materials as “Barro vermelho” (red loam) and consider them the best for the cultivation, especially of banana and manioc (Chart 2). As in the case of the above-mentioned “terra preta” (dark earth), when organic horizons are present, all farmers share the notion of superior fertility attributed to them. As described by a 58 y/o woman from Engenho Jundiá and a 74 y/o man from the Trigueiro Quilombola community, the dark earth is more “estrumada” (manured).

The “barro amarelo” (yellow loam) corresponds to the patches of yellow argisols and latosols. According to a 56 y/o Woman from Engenho Jundiá Community, “é uma terra fraca, é uma terra lavada” (it is a weak earth, washed down) due to the intense use under sugarcane monoculture. As classically recognized by Andrade (1971) for the wet coastal façade of the State, the longstanding growth of this monocrop has depleted the soils and led to the loss of the surface horizons and outcropping of the underlying bedrock or regolith mantles (FONSÊCA *et al.*, 2016; PORTO, 2017). However, under dry Weather, these soils are moderately resistant to erosion. A 56 y/o Woman from Engenho Jundiá Community reported that in a field “a terra esquenta por conta daquelas pedras, quando bate o sol a terra esquenta por conta daquelas pedras na lavoura, aí aquela lavoura vai afracando e vai amarelando” (lit., the Earth heats up due to those rocks in the crops, the crops weaken and turn yellow) (Chart 2).

As the questionary addressed the landforms, it revealed an interesting correlation between the morphology of the land, soil color, and land use. According to a 56 y/o Woman from Engenho Jundiá Community “você vai alí naquela área de cima e em baixo a terra é diferente” (lit., you go to the higher ground and in the lower ground the earth is different). Likewise, sediments deposited on the floodplains are deemed fertile “estrumada” (manured) (60 y/o man, Engenho Jundiá). A 56 y/o woman from Engenho Jundiá says this is good for cultivation since the sediments coming from the side slopes “desce com o estruminho, é bom para plantar” (lit., it comes down with a bit of manure, which is suitable for growing a crop) (Mulher_56 anos_Jundiá).

Among the soil classes of the area, the only type not recognized by the farmers was the chromic luvisols. This lack of reconnaissance can be directly attributed to its position in the landscape. In the case of the Engenho Jundiá, patches of luvisols are often thin, unfertile, and present strong surface stoniness (FONSÊCA, 2018) compared to the other soil classes (Chart 2).

Regarding morphogenetic processes, small-scale producers point out the relation between soil type and land use and ponder that the absence of vegetation leads to soil loss “perda de terra.” Thus, the most erosion-prone areas, for most interviewees, are those under some crop cultivation, followed by pastureland due to cattle trampling.

According to the above, the questionary application with traditional Community farmers resulted in totalizing classifications of geoforms that were closely aligned with the academic geomorphological knowledge. Furthermore, the interviews have also revealed a shared regional heritage between the communities, as attested by the convergence of speeches, environmental perception, and cultural traits. The closeness between the study areas accounts for most of the similarities.

Chart 2 – Ethnopedogeomorphological designation of the Engenho Jundiá dwellers and the Trigueiro Quilombola Community. Soil data correspond to the deatailed pedological map of the studied areas.

Engenho Jundiá dwellers				Trigueiro Quilombola Community			
Geomorphological Units	**Ethnopedogeomorphological Units**	**Pedological Units**	**Ethnopedological Units**	**Geomorphological Units**	**Ethnopedogeomorphological Units**	**Pedological Units**	**Ethnopedological Units**
Dissected elluvio-colluvial summits	*Serra* (range), *Lugar alto* (higher ground)	Yellow Argisol (PA)	*Barro Amarelo* (Yellow loam)	**Dissected elluvio-colluvial summits**	*Serra* (range)	Yellow Argisol (PA)	*Barro Amarelo* (Yellow loam)
Dissected elluvio-colluvial hillslope	*Ladeira* (hillslope), *Ladeirão* (steep hillslope)	Yellow Latosol (LA)	*Barro Vermelho* (red loam)	**Dissected elluvio-colluvial hillslope**	*Ladeira* (hillslope)	Yellow Latosol (LA)	*Barro Vermelho* (red loam)
Multi-convex hilly morphologies	*Chã* (flat summit), *Lombadas* (rump-back summit)	Red Argisol (PV)	*Barro Vermelho* (red loam)	**Multi-convex hilly morphologies**	*Chã* (flat summit), *Lombadas* (rump-back summit)	Red Argisol (PV)	*Barro Vermelho* (red loam)
Sharp hilly morphologies	*Morros* (hiils), *Colina* (lower hill)	Red - Yellow Argisol (PVA)	*Barro Vermelho* (red loam)	**Sharp hilly morphologies**	*Morros* (hiils)	Red - Yellow Argisol (PVA)	*Terra Preta* (black Earth), *Massapé* (clayey soil)
Terraces and alluvial plains	*Vargem* (floodplain), *Vazante* (flow), *Lugar baixo* (lower ground)	Haplic Gleysol (GX)	*Terra Preta* (black Earth)	**Terraces and alluvial plains**	*Vargem* (floodplain), *Vazante* (flow), *Baixada* (lowlands)	Chromic Luvisol (TC)	- Unidentified -

Source: Authors (2022).

FINAL CONSIDERATIONS

From the standpoint of ethnopedogeomorphology, it was verified that the analysis of the relationships between traditional rural communities and the physical landscape does not consist only in correlating the landforms with surface processes. To understand how the knowledge of a lived landscape by a group of small farmers is built, it is essential to add the relationship with the pedological covers since the soil and the relief are inseparable units for those who live and produce food on the land.

The approach adopted in this research revealed essential aspects of small producers' traditions and life experiences. Its knowledge derived from the practice and experience of the natural production cycle contributes to food security for families and income generation. An intimate and comprehensive relationship was observed between the interviewees and nature mediated by agricultural practices and their positioning in the physical landscape. The classifications and terminologies adopted by local populations enrich the relationships between soils, relief morphologies, and surface processes, presenting a great convergence with the nomenclature of academic geomorphology.

Studies focusing on ethnoscience in the context of physical geography are still rare, so the results obtained from this research can serve as a subsidy for elaborating and implementing public policy projects in favor of more participatory and sustainable local development. Furthermore, it is understood that the contribution of traditional knowledge is essential for good planning and environmental ordering practices in rural areas. In this way, ethnopedogeomorphological assumptions can effectively contribute to mitigating environmental problems that affect food production, adding to current practices, experiences, and customs of traditional communities.

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