The linguistic encoding of landscape in Lokono
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5. Vegetation terminology

Folk ecotopes highlight features of the landscape useful for people making a living off the land. Landscape is not a tabula rasa on which culture elaborates; rather, the relationship between land and classification or understanding of land is a feedback loop that takes in both the potential of the land and human ways of making a living, including human technologies, cosmologies, and knowledge systems.

Hunn and Meilleur (2012:3)

The dualistic view of nature and culture (or the land and the classification or understanding of land using Hunn and Meilleur’s words from the quote above) is an idea deeply imprinted on our everyday ways of thinking. So much so, that it is in fact employed to elucidate, for the layman, the very meaning of the French calque dualism in the Oxford Dictionary of English. The nature–culture divide also underlies, as Foley (1997) summarizes in his overview of anthropological linguistics, various theoretical models of culture, albeit it surfaces differently within the many frameworks. In spite of its apparent ubiquity, however, many, including Foley (1997), have taken issue with its usefulness for both theory and practice. Ingold (1992:39), for instance, points out the paradox of maintaining the dichotomy between the external biological (meaningless) environment and culture viewed as the source of all categorization; for if culture is the human form of adaptation to such an environment, it is “an adaptation to nothing at all, and to say that it is adapted is no more than to affirm that culture exists”. Equally problematic is the application of this dualistic view. Recent empirical studies in historical ecology in

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the Amazon region—the geographic focus of this study—demonstrate how hasty Western science had been in judging what is “natural” in the first place. Heckenberger (2009) rightly recapitulates that large parts of what was considered pristine rainforest and savanna show clear and extensive traces of anthropogenic modification (e.g., Balée and Erickson 2006; Denevan 2002). Human ecology contributed to this discussion by showing that much of the biodiversity of certain areas is in fact maintained and even enhanced as the result of the interaction between the indigenous populations and their environment (e.g., Hornborg 2005; Posey 1985). Unfortunately, the nature–culture divide underlies also many decisions related to landscape management, development and policy, often detrimental to the local populations. The modernization process of the Amazon region, for instance, has been greatly shaped by the idea that the “empty” environment can be filled with “meaningful” infrastructure (Hecht and Cockburn 1989). Such theoretical and practical considerations undermine the simplistic idea of nature as “tabula rasa on which culture elaborates”, and are the point of departure for taking a different course, succinctly summed up in Hunn and Meilleur’s quote.

Instead of viewing the land and the classification or understanding of land as disparate worlds, a unifying account can be adopted originating in the writings of Gibson (1979). To him, the organism and its concomitant environment are involved in an ongoing mutual relationship, or a feedback loop in Hunn and Meilleur’s words. Paraphrasing Foley (1997:8), the organism responds to the inherent sensorimotor features afforded by the environment; the environment, in turn, is what the organism takes it to be through the sensorimotor apparatus. In each such loop, the organism and the environment codetermine each other. The process of categorization stands central in this reciprocity. Categorization, from this perspective, is “any systematic differential interaction between an autonomous, adaptive sensorimotor system and its world” (Harnad 2005:21). When an autonomous sensorimotor system categorizes, it abstracts from the afforded stimulus which kind of input systematically produces a given output. Foley’s (1997:8) pivotal example of the relation between an organism and its environment, inspired by the earlier work by Maturana and Varela (1987) and Varela et al. (1991), is the amoeboid movement. When the environment affords a food source, its presence brings on a change in the chemical composition of the environment that is registered by the amoeba’s sensorimotor apparatus, its membrane. This in turn prompts changes in the consistency of the amoeba’s protoplasm causing a part of it to extend toward the food source. As a result, the amoeba moves closer to it, eventually encapsulating and absorbing it. It is through the process of categorization that the organism learns— learning is the adaptive aspect of categorization.

The human being is, of course, not a protozoan, but a multicellular organism with a robust nervous system. Not only do we have a much more elaborate sensorimotor apparatus than an amoeba, which allows us to see, hear, smell, taste, touch, and manipulate objects, we have also greatly extended our sensorimotor capabilities through the development of a plethora of tools. As social creatures, our input is also enhanced by interacting with other humans; we can learn through observation, whether it is an unsupervised process or one supplemented with corrective feedback. Probably the most important evolutionary adaptation of our species is the development of speech, which allows us to learn not only through the
trial-and-error method grounded in sensorimotor experience but also through hearsay. We can be implicitly or explicitly told how to categorize an entity, without having to rely on detecting its properties through direct sensorimotor experience. In fact, much of the knowledge that we have accumulated through centuries is passed on by word of mouth, or its written equivalent. Importantly, however, the mechanism remains the same, as Foley illustrates with the example from the domain of ecological knowledge:

Knowledge and interaction are interdependent things. We know a plant as a weed by virtue of our cultural practices which remove unuseful plants; these cultural practices in turn lead us to label some plants as weeds.

Foley (1997:21)

From this perspective, language and cultural practices are inextricably linked to each other as codeterminants. An important lesson to learn from the amoeba analogy is that language is the human chemical of choice, so to speak. Just like amoeba’s membrane has been tuned in to selectively detect chemicals signaling food sources, human language has been calibrated to coordinate actions socially, not merely to name things. The procedure through which this calibration occurs is the same general process of categorization described above. We abstract from the linguistic material afforded by others which kinds of input systematically produce a given output. This process starts early on; Clark demonstrated (Enfield 2008) that in the process of learning the meanings of words and linking words to their real-world referents, children are guided by their parents’ selection of contextualized uses. Enfield (2008) adds, following Brown (1958), that the process is never finished. In his study of the discourse in which Lao landscape terms are used, Enfield (2008) explains that we continue to calibrate our vocabulary as long as we live through continuous (linguistic) interaction with others. It is the result of this calibration that becomes “the (effectively) fixed and conventional semantic representations which linguists are in the business of describing” (Enfield 2008:248).

The study of words and their meanings in a given language should thus not be approached from the classic utilitarian perspective advocating that lexical categories reflect the affordances of the referents to the community of speakers (e.g., Hunn 1982). Words are useful in the first place as the chemical of choice itself—a means to escape the drudgery of having to learn every category through sensorimotor experience. We use words to communicate categories, and in the larger picture, to coordinate social actions. In other words, following Enfield (2008), the utility of words (as electric impulses in our social network), rather than the utility of their referents (as in the traditional utilitarian account), is the operative force behind the development of a lexicon. As such, the meaning of a word is a palimpsest of contextualized cultural and linguistic practices, rather than a direct reflection of the utility of the referents, just like Foley’s weed example shows. Our practices are in turn grounded in the external world embodied by our sensorimotor apparatus. In simple terms, the evolutionary advantage of language is not merely to categorize entities according to their affordances, but to be able to communicate the embodied categories to others in order to coordinate social actions.
The analysis of contextualized conversational data—that is, observing how people actually navigate spontaneous interaction with words—is therefore a good method for approaching semantics. Rephrasing Brown (1958:228), to apprehend the meaning of a word is to filter out from the linguistic input the invariance that allows one to form the right hypothesis about its semantic content. Unfortunately, in the case of critically endangered languages such as Lokono, which is no longer spoken on a daily basis, conversational data are scarce. This is particularly true for the domain of ecotopes in Lokono, the focus of this chapter, which has been greatly affected by language erosion. As a result, we have to turn to other methods in order to be able to “flesh out the labels with conceptual content”, as Enfield (2008:253) puts it. What is more, landscape has only recently come to the attention of linguists (e.g., Burenhult 2008b). This new strand of research is partly grounded in other, better-studied domains such as ethnobiology (e.g., Berlin 1992). Yet, cognitive geographers such as Smith and Mark (2003; 1999) warn us that geographic-scale features (e.g., forests) are profoundly different from subgeographic entities (e.g., trees) in terms of their ontological features (e.g., type of boundary). It is thus questionable whether established methodologies and theoretical assumptions from better-known domains of the subgeographic scale can be directly applied to landscape. As a result, this chapter is necessarily exploratory in its embodied anthropological framework transcending the nature–culture divide and its methodological toolkit combining techniques from ethnoecological and psychological research to shed light on the linguistic encoding of ecotopic vocabulary.

The focus of this chapter is the Lokono ecotopic terminology. Following Hunn and Meilleur (2012:16), ecotopes are defined as “the smallest ecologically-distinct landscape features in a landscape mapping and classification system”. Ecotopes are spatially realized as ecotopic patches, the tokens of ecotopes. In this chapter, I focus on a subdomain of ecotopes, namely ecotopes defined by the presence of a certain floral taxon. In Lokono, two suffixes, –wkili and –wkaro, are used to derive terms for such ecotopes. Take as an example awarhawkili ‘an area of the awarha palm’, or mokorowkaro ‘an area of the mokoro reed’. The aim of this chapter is to elucidate the semantic difference between the two naming strategies within the theoretical framework transcending the nature–culture divide and its methodological toolkit combining techniques from ethnoecological and psychological research to shed light on the linguistic encoding of ecotopic vocabulary.

A taxon is a taxonomic unit, such as a species, genus, or family. It should be kept in mind that the taxa recognized by the Lokono do not have to correspond one-to-one to scientific classifications. As far as we know this is not the case for the data reported here, though two of the taxa (beyokha and mokoro) could not be identified with certainty.
saturation can be useful in coordinating social actions (§ 5.3). As a way of closing the discussion, I summarize the findings (§ 5.4).

5.1 The Lokono language, society, and landscape

The Lokono people were traditionally semi-settled agriculturalists, whose main crop was khali ‘bitter cassava’. They also practiced hunting, fishing, and gathering. Their villages were located on the border of the tropical rainforest and savanna, usually in the vicinity of creeks and rivers, which used to serve as the main transportation network. The Lokono traditional beliefs were animistic in nature, and the medicine-man used to occupy the central position in the spiritual life of a village (e.g., Goeje 1943; Roth 1924; 1915). Today, however, most Lokono people have entered into the local cash economy, rendering the traditional subsistence practices less important. Transportation on land has become widespread, and the role of watercourses for subsistence practices (e.g., fishing) has diminished. The main creed today among the Lokono is Christianity, though some animistic beliefs are still popular. In general, the Lokono lifestyle today is less dependent on the local landscape (see Molendijk 1992; Rybka 2015a; VIDS 2008 for more details on the current socioeconomic situation).

The Lokono inhabit the peri-coastal areas of the Guiana Shield. The area is typified by grass and shrub savanna dominating the higher lying grounds. Dissecting these plateaus are numerous creeks and rivers (see Rybka 2015b for a discussion of Lokono landform terms). The valleys formed by these watercourses are the domain of the rainforest, large parts of which are seasonally flooded. The villages scattered across the Guiana Shield differ, however, in terms of the specific biotic and abiotic composition of the local environment, which, in some cases, has led to specialized exploitation of resources. The data reported here were collected in the district of Para, Suriname (see Figure 16), mostly in a hamlet called Cassipora, but also in Matta and Powakka (known in Lokono as Kasuporhi, Korhopa and Pwaka, respectively).
5.2 Lokono ecotope terms

The Lokono classify the vegetation around them in two categories: konoko ‘rainforest’ and karhow ‘savanna’, as well as into a number of smaller ecotopic patches that are the topic of this chapter. The ecotopic vocabulary was collected using a combination of methods. Some of the terms were first extracted from the digital corpus of Lokono narratives amassed by the author since 2009 (see the Archive of the Lokono Language at the Language Archive of the Max Planck Institute for Psycholinguistics in Nijmegen). The list was then enlarged through a free listing task, in which 18 speakers from Cassipora, Matta, and Powakka took part. Finally, a few transects through the Cassipora village territory were conducted in order to elicit more ecotope terms in situ, to get a better idea of the ecotopic patches themselves, and to collect their geographic coordinates using a GPS device. In total, 13 ecotope names were recorded. The list was then shortened to nine that were known to all ten consultants from Cassipora who participated in the three experiments described below. All ten consultants (nine men, one woman) were native speakers of Lokono, between 50 and 90 years of age.\(^{67}\) The experiments were

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\(^{67}\) Women in general were not willing to volunteer the data for these experiments, claiming that they are not experts on the topic. However, this may reflect generational or individual differences between female speakers; the one female included in the sample was
conducted in Lokono, though a lot of code-switching took place (between Lokono and Dutch, the two languages the author and the participants have in common). Table 47 lists the nine ecotope terms familiar to the ten consultants, together with the Lokono names of plant taxa from which they are derived, and the Western scientific classification of their referents.  

<table>
<thead>
<tr>
<th>Ecotope term</th>
<th>Lokono taxon</th>
<th>Western scientific classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>beyokhowkili</td>
<td>beyokha</td>
<td>unidentified taxon (Poaceae)</td>
</tr>
<tr>
<td>dakamawkili</td>
<td>dakama</td>
<td>Dimorphandra conjugata (Caesalpinaceae)</td>
</tr>
<tr>
<td>walabawkili</td>
<td>walaba</td>
<td>Couratari stellata (Caesalpinaceae)</td>
</tr>
<tr>
<td>korhwabanawkili</td>
<td>korhwa</td>
<td>Attalea sagotii (Arecaceae)</td>
</tr>
<tr>
<td>avarhawkili</td>
<td>avarha</td>
<td>Astro Caryum vulgare (Arecaceae)</td>
</tr>
<tr>
<td>itewkili</td>
<td>ite</td>
<td>Mauritia flexuosa (Arecaceae)</td>
</tr>
<tr>
<td>manakowkaro</td>
<td>manaka</td>
<td>Euterpe oleracea (Arecaceae)</td>
</tr>
<tr>
<td>tiritiowkaro</td>
<td>tiriti</td>
<td>Ischnosiphon arosus (Marantaceae)</td>
</tr>
<tr>
<td>mokorowkaro</td>
<td>mokoro</td>
<td>Ischnosiphon sp. (Marantaceae)</td>
</tr>
</tbody>
</table>

It should be mentioned that this is a surprisingly low number of plant-based ecotopic terms. Studies of other languages, including languages from the same family, documented four to ten times more items (see Table 48). It is quite likely that the small number of extant ecotope terms in Lokono is a reflection of the endangered status of the language. Another contributing factor may be the fact that the Lokono participate today in the mainstream economy, therefore the type and intensity of the interaction with the local landscape have changes, as described above.

It is familiar with all the ecotopes, and eager to discuss them. Her knowledge does not seem to differ from the other participants.

The scientific classification of Lokono taxa comes from a number of previous studies (Fanshawe 1996; 1950; 1948; Outer 2001; Patte 2011). I have tried to confirm these classifications, where possible, by discussing the features of the plants with the Lokono, and comparing them to the scientific descriptions. The plants reported here are for the most part well-known species, and there is little doubt about their classification.

In one case the base, from which the ecotope is derived, is complex itself. The term korhwaba ‘korhwa’s leaf’ consists of korhwa ‘Attalea sagotii’ and bana ‘leaf’. The ecotope korhwabanawkili ‘area of the korhwa leaves’ is thus derived from a noun denoting a part of the plant—a leaf used for weaving thatched roofs. This exception can be probably attributed to phonological restrictions.
Interestingly, in spite of the quantitative differences, there are also qualitative similarities between Lokono and the other investigated languages. Wartmann and colleagues (n.d.) point out, for instance, that in the six languages listed in Table 48, palm trees are the most represented family. This is also the case for the Lokono data set, in which four out of nine plants that dominate the ecotopes belong to the family *Arecaceae* (see Table 47).

Figure 17 below gives the approximate locations of the major ecotopic patches in the Cassipora area. The ecotopic patches were either mapped with a GPS device during transects or, if not accessible due to seasonal flooding of parts of the forest, their approximate location was indicated on a large scale map by the inhabitants of the village. As mentioned before, not every village has access to the same ecotopic patches. In Cassipora, the patches of *îtekilî ‘îte area’* are in fact small, and the inhabitants regularly remark that *îtekilî* is typical of Matta, one of the other two Lokono villages where data were collected. It is for this reason that some people visit Matta to collect *îte* leaves to make *thishiri*, a type of twine from which hammocks can be woven, or buy it ready from the inhabitants of Matta. Powakka in turn does not have a patch of *beyokhîkî ‘beyokha area’*, which is a place of special spiritual value, since the medicine-man’s flute used to be made from the *beyokha* reed (see also Izikowitz 1935; Mink 1992; Wright 2011). It is quite likely that these, and other villages once participated in a network of cultural exchange that reached far beyond the Para district and involved a number of exchanged items and ecotopes (see also Eriksen 2011).

### Table 48.
**PLANT-BASED ECOTOPE TERMS IN SIX AMAZONIAN LANGUAGES.**

<table>
<thead>
<tr>
<th>Number of ecotope terms</th>
<th>Language (family)</th>
<th>Country (reference)</th>
</tr>
</thead>
<tbody>
<tr>
<td>36</td>
<td>Kayapó (Ge)</td>
<td>Brazil (Posey 1985)</td>
</tr>
<tr>
<td>47</td>
<td>Matsés (Panoan)</td>
<td>Peru (Fleck and Harder 2000)</td>
</tr>
<tr>
<td>59</td>
<td>Takana (Tacanan)</td>
<td>Bolivia (Wartmann et al. n.d.)</td>
</tr>
<tr>
<td>69</td>
<td>Matsigenka (Arawakan)</td>
<td>Peru (Shepard et al. 2001)</td>
</tr>
<tr>
<td>89</td>
<td>Tsimane’ (Mosetenan)</td>
<td>Bolivia (Riu-Bosoms et al. 2014)</td>
</tr>
<tr>
<td>90</td>
<td>Baniwa (Arawakan)</td>
<td>Brazil (Abruão et al. 2010)</td>
</tr>
</tbody>
</table>
Figure 17.—Map of the major ecotopic patches in the Cassipora area. (1=dakamawkilil, 2=korhawanawkilil, 3=itewikilil, 4=manakowkarol, 5=walabawkilil, 6=awarhawkilil, 7=mokorowkarol, 8=tirtiowkarol, 9=beykhowkilil).

It should be noted that participants in general named only one ecotopic patch per ecotope, which may be mistakenly taken to indicate that we are in fact dealing with proper names. This is, however, not the case; the nine terms are clearly generic, as evidenced by their combinatorial possibilities with collective marking, the indefinite pronoun, and numerals (see chapter 6). The one-to-one correspondence between ecotopes and their patches stems from the fact that the largest patches are the most important ones. The participants did confirm that there are also smaller patches of the nine ecotopes types, but they found them too unimportant to discuss or map them. This explains also why the ecotopic patches are all relatively close to the village—the Lokono concentrate their attention on the nearest, most accessible patches. It should also be noted, however, that some of the consultants are elderly people, who do not venture far into the forest anymore. The proximity of the patches may therefore also be attributable to the fact that the area from which resources are exploited shrinks as one becomes old. Notice that I do not mean to say here that the knowledge of ecotopes shrinks with age; as is usually the case with many domains of culturally-specific knowledge, it is the elders who seem most knowledgeable in the realm of ecotopes. I argue here only that the fact that the distribution of the ecotopic patches in close vicinity of the village may be a reflection of the fact that only elderly speakers—the knowledgeable ones, who cannot venture far into the forest—make use of the patches.
As far as the internal structure of the terms is concerned, the Lokono label the
etocopic patches using two types of terms—namely, nouns derived with the suffixes
–wkili or –wkaro from a noun denoting a plant taxon. The two suffixes, though not
analyzerable from a synchronic perspective, share a common element –wkV, where the
V is a vowel that might have been harmonized with the final vowel in the case of the
suffix –wkili. The shared element is most likely a reflex of the suffix –wka, deriving
stative verbs describing general features of an area, for instance, sawkan ‘sunny,
pleasant’, bawkan ‘cloudy, unpleasant’, tehokan ‘densely vegetated, unpleasant’
and mowkan ‘fully cleared from vegetation, open’; the final –n in these forms is a
nominalizer typically used when giving the citation form of a verb. However, the
suffix –wka cannot be added to plant-denoting nouns on its own; the two
combinations, –wkili and –wkaro, are clearly lexicalized. The final elements of the
suffixes are the masculine and feminine markers –li and –ro, respectively. The two
types of ecotope terms function as nouns and denote areas; they combine with a
specialized locative marker typical of place-denoting nouns (i.e. the where-marker,
discussed in preceding chapters). With the exception of Wartmann and colleagues
(n.d.), the studies mentioned in Table 48 do not focus on the linguistic features of
the terms. As far as I know, there has been no mention of a differential derivational
process in the literature on ecotopes such as the one described for Lokono in this
chapter.

Traditional elicitation methods have failed to elucidate the meaning difference
between the two types of derivational strategies in Lokono—the speakers were
unable to formulate how the two types of ecotope terms differ. Most speakers, when
asked directly about the difference, said that there is none. However, if I tried to
switch the suffixes in order to coin a term such as *awarhowkaro, instead of the
attested awarhawkili ‘area of the awarha palm’, a few people commented that
awarha (Astrocaryum vulgare) does not grow like that. There was thus
impressionistic evidence that there is a difference in meaning between the two
strategies. In the absence of conversational data from which the semantic distinction
could be abstracted, the experiments reported below aimed at bypassing this obstacle
by approaching the meaning of the ecotopes from a different angle.

5.2.1 Experiment 1: perceived floristic composition

Since the participants’ impressionistic comments about the two suffixes touched on
the type of vegetation found in the different ecotopes, the first experiment explored
the Lokono knowledge of the floristic composition of each ecotope type. During
individual sessions at a consultant’s house, each of the ten participants was asked to
list plants that are typically found in each of the ecotopes.  

Importantly, I have thus not recorded the “real” floristic composition of the
ecotopes (i.e. the real abundance of the taxa), but the picture thereof that the

The experiment did not revolve solely around plants. I have asked the consultants to list
also animals associated with a particular ecotope, describe the features of the soil, and the
uses of the resources found in each ecotope. These findings are, however, irrelevant to the
present discussion.
inhabitants of Cassipora have, which is determined, on the one hand, by the real composition of the environment and, on the other hand, by the perceptual salience of the taxa (ultimately codetermined by the human sensorimotor system) and their cultural significance to the Lokono people (for subsistence practices, beliefs, etc.). This is an important assumption reflecting the theoretical approach adopted from the perspective of which the dichotomy of nature–culture is not relevant. Similar studies in landscape ethnoecology do acknowledge the problem of using free listing as a measure of abundance, but nonetheless tend to endorse it as such (e.g., Abraão et al. 2010:97).

5.2.1.1 Analysis and results

Altogether, the participants listed 52 plant taxa. The results were organized into an agglomerated table of 9 rows (cases=ecotopes) and 52 columns (variables=taxa), recording how many participants (out of ten) have associated a particular taxon with a particular ecotope. In order to investigate which ecotopes are similar in terms of the perceived floristic composition, I conducted a cluster analysis using Ward’s method in SPSS. Ward’s method compares the 9 cases across the 52 variables in order to generate a tree diagram (a dendrogram) visualizing the similarities between the cases. The result is given in Figure 18.71

71 Please notice that the in Figure 18, Figure 19, and Figure 20 the term itewkili is written with a short <i> instead of the long <î> since I could not input such diacritics into the SPSS data sheet.
Figure 18 depicts the similarities between ecotopes in terms of the perceived floristic composition. The hierarchical cluster analysis using Ward’s method detected a number of clusters, and two major groupings, coinciding with the two derivational strategies for forming the names of ecotopes, the \textit{wkili}- and \textit{wkarō}-terms. The \textit{wkili}-ecotopes are thus similar to each other in terms of the perceived floristic composition and different from \textit{wkarō}-ecotopes (and vice versa), a finding in line with the participants’ impressionistic commentaries. Let us assume that the correlation between the perceived floristic composition and the linguistic expression is not accidental—that is, that the \textit{wkili}-ecotope terms encode ecotopes different from \textit{wkarō}-ecotope terms in a way that accounts for the perceived floristic composition. The question then arises whether we can identify a unique parameter explaining the observed distribution (as opposed to the 52 parameters used in this exploratory clustering experiment) that has motivated the Lokono grammatical distinction.

5.2.2 Experiment 2: similarity judgment (triads)

In order to investigate which unique parameter may underlie the grammatical distinction a second experiment was conducted exploring how similar the different ecotopes are to each other according to the Lokono. Eight participants were given a set of nine cards with ecotope names on them to sort through, and check if they feel knowledgeable enough to discuss all of them, and to make sure they had no
problems with reading the labels. Subsequently, I used a triadic comparison method, in which the participants were presented with one triad at a time, each consisting of three ecotope cards. For each triad the participants were asked to pick two ecotopes that were similar, and one that was the odd one out. The participants were explicitly instructed not to think about the labels (i.e. not to judge the linguistic form), but to think about the areas they denote and to exercise their freedom in which features of the areas to compare and prioritize (e.g., floristic composition, utilitarian considerations, aesthetic aspect, abiotic features of the area, etc.). Before the experiment started, a few trial triads were presented to make sure the form of the experiment was clear to the participants. Since a set of all possible permutations of cards would consist of 84 triads—a set too large to test with the speakers—a balanced incomplete design developed by Burton and Nerlove (1976) was used. This resulted in 24 triads, in which each pair of ecotopes appears twice. The triads were presented to the participants in a pseudo-random sequence to minimize order effects (see also an inspiring paper by Wnuk and Majid (2014), a study of the smell lexicon of a hunter-gatherer group in Thailand using similar methodologies).

5.2.2.1 Analysis and results

The similarity data obtained from the eight participants were organized into an agglomerated table recording how many participants have deemed each pair of ecotopes to be similar. The data was analyzed using the multidimensional scaling procedure (MDS) called PROXSCAL in SPSS. The MDS algorithm spatially models the numerical data, representing the reported similarity distances between the nine ecotopes, in order to detect how many dimensions best preserve the original distances in the data set, while reducing the number of dimensions. The maximum number of dimensions is the number of cases minus one—an eight-dimensional solution would perfectly fit this data set, but would not illuminate the results. MDS calculates the stress value for each of the eight possible dimensions—that is, how much the data needs to be distorted to fit a given dimensionality. Increasing dimensionality always results in lower stress. The best fit is the dimensional solution that results in a significant reduction of stress, while at the same time a further increase of dimensionality reduces the stress insignificantly. For the Lokono ecotopic data, a two-dimensional solution given in Figure 19 best preserves the similarity distances.

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72 I could not explain the rules of the experiment clearly enough to two elderly participant, therefore they were excluded from the sample.

73 Burton and Nerlove (1976) show that a balanced incomplete design, in which each pair appears twice, is highly reliable, as opposed to a set, in which each pair appears only once.

74 The stress value for a one-dimensional solution was .41, which is poor, but a two-dimensional solution reduces stress to .12, which is fair (see Kruskal 1964), but adding an additional dimension reduces stress only by 0.04. The Dispersion Accounted For (DAF), a measure of the variance accounted for, increases from .83 (one dimension) to .98 (two dimensions). Adding an additional dimension increases DAF only by .01.
Figure 19 visualizes the similarities between the ecotopes: the *wkili*-ecotopes, represented by dots, occupy mostly the right side of the space. The *wkaro*-ecotopes, represented by rhombi, are grouped closely together on the left, echoing the results of the cluster analysis in the first experiment. The MDS analysis shows that two dimensions best model the similarities between the ecotopes, but it does not tell us what these dimensions are—that is, we know that two parameters guided the participants’ similarity judgments, but we do not know what these parameters were. However, by looking at the distribution of the ecotopes in Figure 19 along the two dimensions we can hypothesize what the relevant parameter may be. Moving from left to right on the horizontal dimension 1, the ecotopes change from clearly wet (*tiritiowkaro*, *mokorowkaro*, *manakowkaro*, *itewkili*) to relatively dry (*beyokhowkili*, *dakamawkili*, *korhwabanawkili*, *walabawkili*), and to very dry (*awarhawikili*). The vertical dimension 2 is less straightforward. Moving from the bottom to the top, the ecotopes seem to change from less to more open type of vegetation. Clearly, however, it is the horizontal dimension 1 that correlates with the distribution of the derivational strategies—that is, on the vertical dimension *wkili*-ecotopes are all over

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Englund rightly points out that other statistical procedures could be used, for instance, the Principal Component Analysis, which could allow us to rotate the axes and look for a different, maybe better fit. For instance the ecotope terms could be organized into groups, formed by drawing a line more or less where along the diagonals in Figure 19. I have not attempted to try such an analysis, as the present distribution echoes the results form the first experiment.
the spectrum, while on the horizontal one, there is a cut-off point between the *wkili-* and *wkaro-*ecotopes. The question arises whether we can find supporting evidence for the observed distribution, and the hypothesized nature of the horizontal dimension.

5.2.3 Experiment 3: underlying parameters (pile sorting)

In order to corroborate the findings of the second experiment, a third experiment was conducted aimed at verbalizing the underlying parameters. The eight participants were given the same set of nine ecotope cards, and were asked to sort them into as many piles as they wished, on the condition that each pile includes only similar ecotopes. Similarly to the second experiment, the participants were explicitly instructed not to think about the names of the ecotopes and were free to make similarity judgments on whatever parameter they saw fit. This experiment, however, allowed the participants more freedom in creating the groupings, as opposed to the second experiment, in which the triads are predefined by an algorithm (see Burton and Nerlove 1976). The second experiment could have therefore distorted the picture (i.e. if a certain triad included three very similar ecotopes from which one nevertheless had to be eliminated). Having created the piles, the participants were asked to explain why certain ecotopes belong together in an attempt at verbalizing their similarity judgments.

5.2.3.1 Analysis and results

The similarity data obtained from the eight participants were organized into an agglomerated table recording how many participants have deemed a set (i.e. a pile) of ecotopes similar. The data was again analyzed using PROXSCAL in SPSS. For this set of ecotopic data, a two-dimensional solution given in Figure 20 best preserves the similarity distances.

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76 The number of piles created did not vary much, but as Englund points out the participants who created less piles had a bigger impact on the results.

77 The stress value for a one-dimensional solution was .38, which is a poor fit; a two-dimensional solution reduces stress to .15, which is a fair fit (see Kruskal 1964), but adding an additional dimension reduces stress only by .06. The DAF increases from .85 (one dimension) to .98 (two dimensions). Adding an additional dimension increases DAF only by .01.
Figure 20.—A two-dimensional solution produced by MDS analysis. The similarities between the ecotopes collected with the pile-sorting method (wkili-ecotopes are represented by dots, wkaro-ecotopes by rhombi).

Figure 20 echoes the results from the second experiment, though there are certain interesting differences. The wkaro-ecotopes, represented by rhombi, still occupy the left side of the space. However, manakowkaro ‘area of the manaka palm’ is now somewhat further from the other two wkaro-ecotopes, namely mokorowkaro ‘area of the mokoro reed’ and tiritiowkaro ‘area of the tiriti reed’. This can be explained by the fact that mokoro (Ischnosiphon sp.) and tiriti (Ischnosiphon aroama) are closely related taxa, hence their patches are likely to share many features. Spatially too, the ecotopic patches of mokoro and tiriti of the Cassipora area are not far away from one another, which can further add to their similarity score. On the other hand, manakowkaro ‘area of the manaka palm’ is now closer to ëtewkili ‘area of the ëte palm’. Both manaka (Euterpe oleraceae) and ëte (Mauritia flexuosa) are water loving palm trees (as opposed to reed species), which may explain the rearrangement. Interestingly too, the manaka was the only taxon in the set for which some participants agreed that both manakowkaro and manakowkili were acceptable terms. Patches of manakawkaro/manakowkili may well be a border case between the two types of ecotopes. Patches of ëtewkili are also characterized by a border case between the two types of ecotopes. Patches of ëtewkili are also characterized by swampy areas, which is surprising considering that the relevant ecotope is derived with the suffix –wkili, not the –wkaro suffix. However, the question arises where the Lokono place their (culturally specific) cut-off point between wet and dry. Patches of ëtewkili are seasonally flooded, not wet all year round, which may be one relevant factor. Moreover, as opposed to patches of the three wkaro-ecotopes, patches of ëtewkili are found in the savanna (open vegetation) rather than in the forest (dense vegetation); it
may thus be the case that the second dimension plays a role here too. The limited number of extant ecotopes prevents us from solving this quandary. Summing up, except for minor differences, the third experiment corroborates the two-dimensional distribution form the second experiment.

When asked about the created piles, the participants named a few different parameters. In some cases two parameters per pile were named, in order to distinguish piles that shared a feature. The parameters named by the speakers were wet–dry (area), thin–thick (vegetation), open–closed (canopy), and close–far (from the village), of which the last two were used sporadically. As a rule, the participants also created one-member piles, in which they placed ecotopes that they deemed different from all the others; for these residual piles no parameter was named. The agglomerated scores for the two main parameters are given in Table 49, grouped by the two parameters and ordered vertically from wet to dry and thin to thick.

### Table 49.

<table>
<thead>
<tr>
<th>Ecotope</th>
<th>WET</th>
<th>DRY</th>
<th>Ecotope</th>
<th>THIN</th>
<th>THICK</th>
</tr>
</thead>
<tbody>
<tr>
<td>manakowkaro</td>
<td>6</td>
<td></td>
<td>kohrwabanawkili</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>mokorowkaro</td>
<td>6</td>
<td></td>
<td>walabawkili</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>tiritiowkaro</td>
<td>6</td>
<td></td>
<td>tiritiowkaro</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>itewkili</td>
<td>4</td>
<td>1</td>
<td>mokorowkaro</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>dakamawkili</td>
<td>1</td>
<td>1</td>
<td>itewkili</td>
<td></td>
<td></td>
</tr>
<tr>
<td>beyokhowkili</td>
<td>2</td>
<td>3</td>
<td>manakowkaro</td>
<td></td>
<td></td>
</tr>
<tr>
<td>kohrwabanawkili</td>
<td>4</td>
<td></td>
<td>dakamawkili</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>walabawkili</td>
<td>5</td>
<td></td>
<td>avarhawkili</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>avarhawkili</td>
<td>6</td>
<td></td>
<td>beyokhowkili</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

The wet–dry parameter was consistently used to distinguish the three wkaro-ecotopes from the rest, sometimes to the inclusion of itewkili with the wet ecotopes. Three ecotopes were usually considered dry (awarhawkili, walabawkili, kohrwabanawkili) and the remaining two (beyokhowkili and dakamawkili) were deemed neither particularly dry nor wet. It is however striking that the wet–dry parameter is the only parameter of the four named for which each ecotope was scored. Importantly too, the distribution of scores echoes the derivational strategies and the spatial distribution of the ecotopes in the conceptual space of Figure 19 and Figure 20. This lends further support to the hypothesis that the two suffixes, –wkili and –wkaro, are used to coin terms for areas differing in terms of water saturation, with wkaro-ecotopes encoding wetter areas.

The thin–thick parameter was clearly less important to the speakers, and served often as a secondary means of distinguishing ecotopes within a larger dry or wet pile. Though not perfectly, the thin–thick parameter partly aligns with the vertical distribution of the ecotopes in the conceptual space of Figure 19 and Figure 20. Interestingly, it may add to our understanding of some of the groupings noticed earlier. The ecotopes mokorowkaro and tiritiowkaro, which were represented as very similar in the similarity spaces (in both of Figure 19 and Figure 20), have been judged to be not only wet but also characterized by thin vegetation. Similarly,
korhwanawkili and walabawkili, which have been clustered together in all three experiments (Figure 18, Figure 19, and Figure 20), share both the feature dry and thin vegetation. Manakowkaro and itewkili, a clear cluster in Figure 19 were both considered neither thin nor thick, and on the whole quite wet. Finally, beyokhowkili and awarhawkili were both considered to be thickly vegetated, and indeed they occupy the very bottom of Figure 19 and Figure 20. Interesting is the case of dakamawkili, which was considered thickly vegetated once, though it actually occupies the very top of Figure 19 and Figure 20. This anomaly could be explained by the fact that dakamawkili was often left in a cluster of its own (and so was beyokhowkili for that matter). Moreover, it is also possible that I have misunderstood its categorization—dakamawkili indeed is thickly vegetated but not in the same way as, for example, beyokhowkili or awarhawkili. Instead of a thicket, dakama forms patches of savanna forest that are covered with a layer of half a meter of fallen leaves, making it hard to pass through it.

As additional evidence that the second dimension may be the density of vegetation, let me mention the results of another experiment, in which Lokono speakers participated, conducted in 2013 as part of a cross-cultural study of landscape preference. In this experiment, described in detail in Hägerhäll et al. (n.d.), a set of nine computer-generated images of landscape, carefully varied along two parameters, topography and the density of vegetation, was created (Figure 21). The two parameters were chosen since they recur in the theoretical literature as determinants of human landscape preference. Interestingly, notice that none of the images contains a water feature. Water was eliminated form the images since it was believed that it is too central to human landscape, and will thus only obscure the relationship between topography and vegetation density as parameters to be investigated.
The set was then organized into a complete set of pairs. The 25 Lokono speakers who participated in the study (12 men, 13 women) were asked to choose in each pair the image of landscape they preferred as location to live in. The design of the experiment, the analysis, the results of the Lokono data, and the cross-cultural comparison with five other populations are reported elsewhere (see Hägerhäll et al. n.d.). One aspect of the statistical analysis of the data is, however, of importance to this study. In Figure 21, we see that the nine images form three tiers with respect to the density of vegetation, and three tiers with respect to topography. The analysis of the responses showed that all three levels were significantly different to the Lokono speakers in the case of the density of vegetation. This independent finding suggests that the Lokono do pay attention to the density of vegetation when scrutinizing pictures of landscape. It is thus not surprising to see a reflection of that in the domain of ecotopes, in which the secondary dimension along which ecotopes have been classified, appears to be the density of vegetation as well.

### 5.3 Ecotopic distinctions in language and culture

Lokono ecotopic vocabulary, though most likely affected by linguistic and cultural change that prevents us from fully understanding its structure and meaning, shows a split into two groups of terms *wkili*- and *wkaro*-terms. The three experiments have demonstrated that the ecotopes themselves differ in their perceived floristic composition and that two parameters, most likely water saturation and the density of vegetation, best represent the similarities between the ecotopes. Of these two, the
parameter of water saturation parallels the linguistic distribution of the two derivational strategies.

At the onset of this chapter, I have stated that ecotropic vocabulary does not simply reflect the utility of the referents but a complex network of relations between the landscape, human subsistence practices, and knowledge systems that codetermine one another. In light of this, the question arises what the benefit is, in terms of coordinating social action, of grammaticalizing a distinction between wet and dry ecotopes for the Lokono community of speakers. Generally speaking, Hunn and Meilleur (2012:3) hypothesize that the ecotropic distinctions maintained by a community “maximize the spatial predictability of local biotic and other resources”. Water itself is of course an important resource. According to Mark et al (2010:31), one of the founders of the discipline of ethnophysiology—that is, the study of culture-specific systems of landscape categorization—water occupies a central role in human landscape categorization, since it is “essential for human life” and has “especially distinctive affordances”. Mark et al (2010:31) continue that it seems therefore “highly likely that all cultures and languages pay attention to the ways in which water can exist in the landscape”. What they suspected thus is that all languages have terms for kinds of water features. Familiar languages such as English have a number of terms lexicalizing the degree of water saturation, for instance, bog, marsh, quag, fen, mire, swamp and so forth. It is thus not surprising in general that water saturation would be encoded as part of the ecotropic vocabulary, but to find it grammaticalized in the domain of terms for vegetation patches is a new insight—potentially peculiar to the Lokono language.

For the Lokono, taking into consideration their subsistence practices, it is crucial to know that an area is boggy, swampy, or potentially flooded for a period of time. Such areas cannot be easily traversed, which of course impacts the time of travelling from point A to point B, but also makes certain areas, including the areas lying beyond them, seasonally unreachable. Including the component of water saturation as part of the semantic content of the ecotope terms has obvious benefits. Interestingly, accessibility has been mentioned together with the thin–thick parameter as well. Ecotopes that were characterized as thickly vegetated are considered to be difficult to pass through. Beyokhowkili, which is a thicket of entangled bamboo-like shoots and one of the most densely vegetated patches in the sample, was regularly named as a place that is almost inaccessible. The Lokono never enter beyokhowkili, and only engage in subsistence practices (such as harvesting beyokha or hunting for animals nesting in beyokhowkili) at the very edge of the patch.

Availability of water is also a key factor in the swidden agriculture of cassava still practiced today on a minor scale, which requires a well-drained, sandy soil, more typical of the wkili-ecotopes. The same applies to pineapple, which is planted today in the villages for commercial purposes. Of the minor crops such as sweet potatoes, corn, sugar cane, peanuts, and taro, some require dry and some wet soil. Importantly, ecotopes such as korhwabanawkili, walabawkili, and awarhawkili were named by the speakers as good indicators of soils appropriate for cassava, potato, and corn. The wkaro-ecotopes, on the other hand, are considered inappropriate for any type of farming. Water saturation encoded in the ecotope vocabulary is thus also, to a certain degree, a predictor of soil types relevant to agricultural practices.
The grammaticalized distinction based on water saturation allows the Lokono to maximize the predictability of other resources as well. Certain wild plants necessitate a well-watered environment to prosper, while others require drier soils. Indirect evidence of the predictive power of the ecotopic suffixes comes from the first experiment. It is worth reiterating that the speakers consistently associated wkaro-ecotopes with certain exclusive plants not found in the wkili-ecotopes, and vice versa. Many of the plants found in the ecotopes are of great importance to the Lokono culture. In fact, most of the nine plants serving as the indicator species of the areas constitute resources central to the Lokono subsistence practices such as the building of a traditional thatched house (walaba, korhwa, manaka), the weaving of kitchen utensils (tiriti, mokoro, awarha), the gathering and preparation of food (awarha, manaka, ite, korhwa, dakama), and the manufacture of hammocks, clothes, and jewelry (ite, awarha). Listing the affordances of all of the 52 plant taxa volunteered by the speakers is beyond the scope of this chapter, but it should be stressed that there were hardly any for which no use was described by the speakers.

For the Lokono water has also spiritual affordances. According to the traditional system of animistic beliefs, landscape features harbor various spirits. Roth (1915) described the many types of spirits associated with mountains, forests, and water bodies known to the indigenous groups of the Guianas, including the Lokono. Of these, oriyo ‘water spirit’ (from ori oyo ‘mother of snakes’) — the spirit associated with water features — is the most important one, still feared and revered today by the Lokono (see also Goeje 1943). Today cultural practices related to oriyo and areas it inhabits include a restriction on approaching water features for menstruating women and young babies, restrictions on extracting resources from such areas, restrictions on travelling through such areas, and in certain cases even linguistic taboos substituting the name of the place with an avoidance term in order not to anger the spirit. Importantly, the boggy areas that are seasonally flooded by the distributary channels of the creeks, together with deep pools in the bends of creeks, are the places particularly favored by the oriyo type of spirits. The wkaro-ecotopes clearly fall into the first category. For obvious reasons, however, the consultants were not keen to discuss matters involving the oriyo spirit — it is in general not wise to mention or talk about oriyo at all. The few participants who did comment on the topic said that this type of knowledge used to be restricted to the medicine-men, hence they had but little to say about it.

With respect to language it is, however, interesting to observe that from a historical angle the grammatical difference between the –wkaro and –wkili suffixes may come down to the opposition between the feminine and masculine markers –ro and –li, respectively. Typically, the masculine gender is restricted to nouns referring to Lokono men, all other nouns are feminine, placing nouns denoting women, animals, inanimate entities, and the foreign researcher in the feminine category. It is thus somewhat surprising to find exponents of the masculine gender in ecotope terms. Importantly, however, under certain circumstances the masculine gender can be applied to nouns that do not encode Lokono men, namely in order to express familiarity, affection, or a good relationship in general. It is thus worth noting, especially in the face of the linguistic avoidance strategies used by the Lokono with respect to the oriyo, that employing the gender distinction to mark certain ecotopes as good by default could have been part of a larger system of practices related to the
interaction with the oriyo spirits. Wkili-ecotopes, possibly historically marked as masculine, denote drier areas where there is no danger at all of meeting an oriyo. This spiritual aspect of places is detached from their utilitarian aspect; both types of ecotopes are typified by culturally-important resources. Data limitations and cultural taboos, however, prevent us from ascertaining whether grammatical exponents of the masculine and feminine gender indeed served as a subtle beacon of warning.

5.4 Conclusions

Discourse data that could show us how the Lokono ecotopic vocabulary is used to coordinate social actions are not available due to the critical state of the language and culture. We cannot therefore directly observe how the utility of words, as electric impulses in a social network, directed the online usage of these terms, and their historical development as part of the lexicon (Enfield 2008). The picture is further complicated by the fact that methodologically the domain of landscape that I zoom in on here is still largely an uncharted territory, as opposed to better known semantic domains such as the human body, color terms, kinship systems, or the plant and animal kingdoms (e.g., Berlin 1992; Enfield, Majid, and van Staden 2006). Yet, by applying new experimental methods to landscape vocabulary, and subsequently placing the Lokono system within the broader picture of Lokono subsistence strategies and cultural practices, we can reconstruct, or hypothesize, how they were used and how they evolved.

In this chapter, I have specifically explored the semantic difference between two types of ecotope terms: wkili- and wkaro-derivations. In the first experiment, free listed plants associated with each ecotope were clustered using the Ward’s method. The results showed that the two types of ecotopes differ in terms of the perceived floristic composition. The second experiment explored the similarities between the ecotopes through a triadic comparison method. The multidimensional scaling analysis of the results demonstrated that the similarities between the ecotopes could be comprehended in terms of two dimensions. In a third experiment, a pile-sorting method was employed in order to verbalize the speakers’ similarity judgments. It was concluded that the relevant dimensions are water saturation and the density of vegetation. The former parameter correlates with the linguistic pattern, and the latter has also been found to play a role in a landscape preference experiment conducted among the Lokono.

This semantic distinction is, however, meaningless when taken out of the Lokono context, for it is the Lokono subsistence strategies and cultural practices that give meaning to it in the first place. Returning to the quote from Hunn and Meilleur (2012), with which I started the discussion of Lokono ecotopic vocabulary, there is no doubt that the Lokono system of landscape classification described in this chapter collapses the distinction between nature and culture. The Lokono ecotopes clearly reflect the “potential of the land”, which in this case includes information not only about the particular taxon indicating the area but also about the relative water saturation of the ecotope. The “potential of the land” is, however, not an independent factor, but a reflection of the Lokono “ways of making a living”. The maintained system of ecotopic distinctions maximizes the spatial predictability of
plant resources that stand central to the cultural practices of the group—both the plants that indicate the area, and a number of other taxa that are consistently correlated with the two different types of ecotopes. The conspicuous utility of these taxa speaks volumes for the fact that the ecotopic classification does not merely reflect the biodiversity of the area. Rather it filters from it what the Lokono deem important. This applies also to water saturation encoded in the ecotopic vocabulary, which is an additional predicator of plant distribution, but also an indicator of soils appropriate for farming. It also provides clear clues as to the seasonal accessibility of certain areas. Moreover, the two types of ecotopic terms may have been entangled in the Lokono “cosmologies and knowledge systems”, functioning as subtle beacons of warning against certain types of spiritual beings. The wet wkaro-ecotopes are associated with the malevolent oriyo spirits. This may have been reflected in the linguistic form of the terms. Surprisingly, the dry wkili-ecotopes are marked by a masculine derivational suffix –li. The use of masculine gender with entities that do not denote Lokono men, normally implies familiarity, affection, or in more general terms a positive attitude toward the referent. It is thus possible that marking the dry ecotopes as masculine may have been a way of indirectly signaling that there is nothing to be afraid of there. It is also illuminating to notice that the Lokono living in the Cassipora village mapped only one patch of each ecotope, and that the neighboring villages complement each other in terms of the exploitation of the available resources. This stresses the fact that the ecotopic distinctions maximize the predictability of resources—only the nearest patch of optimal size is of importance. It is therefore the Lokono subsistence strategies and other cultural practices such as fishing, hunting, farming, gathering, travelling, sheltering, and avoiding interaction with malevolent spirits that imbue the Lokono ecotopic system of distinction in general, and the concept of water saturation in particular, with meaning. After all every ecotope in the Lokono landscape is statured with water to a certain degree. The Lokono distinction is thus clearly arbitrary, and is only meaningful for the very purpose of coordinating Lokono activities. The recent changes in the way the Lokono people interact with landscape have clearly affected the number and the transparency of the ecotopic distinctions maintained—the vanishing cultural practices go hand in hand with the vanishing ecotopic vocabulary, and ultimately the disappearance of the very ecotopes themselves, as their existence is inextricably linked to the Lokono language and culture. I hope that both the findings and the methodological setup will inspire other researchers to investigate the ecotopic vocabularies of indigenous groups and at the same time to refine the tools used here to study landscape classification from a linguistic angle.