

English

Its song was forgotten and so was its name... The relation between biological and linguistic richness in Santa María Tlahuitoltepec, Oaxaca, México.

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In Mexico, there are 68 indigenous languages, some of them in danger of extinction. In the community of Santa María Tlahuitoltepec the first language of the majority of the population is Mixe or Ayuujk, however, it has begun to be replaced by Spanish in the younger generations. Previous work in this community indicates that the loss of a bird species has caused the disuse of the word in Mixe assigned no name it, as well as the legend associated with the animal. Through mixed ethnographic techniques, this work aims to analyze whether: 1) There are other cases of loss or disuse of the names from biological elements in the community; 2) If the disuse of words in indigenous languages can be accelerated due to the loss of endemic biological wealth in native communities; 3) Associate other aspects of culture and traditional knowledge related to the loss of biodiversity, in order to promote the conservation of traditional ecological knowledge.

Español

Su canción fue olvidada y también su nombre... La relación entre la riqueza biológica y lingüística en Santa María Tlahuitoltepec, Oaxaca, México

En México existen 68 lenguas indígenas, algunas de ellas en peligro de extinción. En la comunidad de Santa María Tlahuitoltepec la primera lengua de la mayoría de la población es el Mixe (Ayuujk), sin embargo ha comenzado a sustituirse por el español en las generaciones más jóvenes. Un trabajo precedente en esta comunidad señala que la pérdida de una especie de ave ha provocado el desuso de la palabra en Mixe asignada para nombrarla, así como la leyenda asociada al animal. A través de técnicas etnográficas mixtas este trabajo plantea analizar si: 1) Existen otros casos de pérdida o desuso de los nombres de elementos biológicos en la comunidad; 2) Si el desuso de palabras en las lenguas indígenas puede acelerarse debido a la pérdida de la riqueza biológica endémica en las comunidades nativas; 3) Asociar otros aspectos de la cultura y el conocimiento tradicional relacionado a la pérdida de la biodiversidad, con la finalidad de fomentar la conservación del conocimiento ecológico tradicional.

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Français

Sa chanson a été oubliée, tout comme son nom... Rapport entre richesse biologique et linguistique à Santa María Tlahuitoltepec, Oaxaca, Mexique.

Au Mexique il existent 68 langues indigènes, dont certaines sont en danger d'extinction. Dans la communauté de Santa María Tlahuitoltepec la première langue de la plupart de la population est le Mixe, connu aussi comme Ayuujk, mais cette langue a commencé à être remplacée par l'espagnol dans les plus jeunes générations. Un travail antérieur dans cette communauté indique que la perte d'une espèce d'oiseau a provoqué la désuétude du mot dans le Mixe attribué à son nom, ainsi que la légende associée à l'animal. Grâce à des techniques ethnographiques mixtes, ce travail vise à analyser si: 1) Il existe d'autres cas de perte ou de non-utilisation des noms d'éléments biologiques dans la communauté; 2) Si la désuétude des mots dans les langues autochtones peut être accélérée en raison de la perte de richesse biologique endémique dans les communautés autochtones; 3) Associer d'autres aspects de la culture et des savoirs traditionnels liés à la perte de biodiversité, afin de promouvoir la conservation des savoirs écologiques traditionnels.

Keywords: indigenous languages, biodiversity, Mixe, Traditional Ecological knowledge (TEK)

Fragment of "Ihcuac thalhtolli ye miqui": "Cuando muere una lengua" from Miguel León-Portilla

Ihcuac tlahtolli ye miqui,
mochi tlamantli in cemanahuac,
teoatl, atoyatl,
yolcame, cuauhtin ihuan xihuitl
ayocmo nemilloh, ayocmo tene-
hualoh,
tlachializtica ihuan caquiliztica
ayocmo nemih

When a language dies,
Everything in the world,
seas and oceans,
animals and plants
are not even think, or pronounce
with glimmers and sounds
that don't exist anymore

Cuando muere una lengua,
todo lo que hay en el mundo,
mares y ríos,
animales y plantas,
ni se piensan, ni pronuncian
con atisbos y sonidos
que no existen ya

1. Introduction

Mexico ranks fifth worldwide in species richness (Llorente-Bousquets & Ocegueda, 2008), and possesses a high diversity of languages. Within Mexico, Oaxaca is one of the states with the greatest linguistic and biological richness with over 157 languages spoken in about 92,000 km² (Toledo, 2009). Ethnobiological studies have found a relationship between the loss of biological diversity and the deterioration of language, especially indigenous ones (Boege, 2008; Saynes-Vasquez, 2013). In this article, we analyze preliminary results of an investigation that we carried out in the Mixe community of Santa María Tlahuitoltepec, on the relationship between the loss of biological richness, linguistic diversity, and cultural wealth. Through interviews with varying age groups in the community, we observed that when a species disappears (green macaw), the word in the native language, as well as the associated legend, were unknown to younger generations (Arriaga-Jiménez et

al., 2018). This work was done through the ethnographic method, using participant observation techniques, semi-structured interviews, and life stories. We also expand on the literature and our initial research by looking at other Mixe words associated with flora and fauna, that can serve as indicators for the loss of cultural wealth in the form of traditional ecological knowledge (TEK), symbolic elements, and mythology.

1.1 Relationship between biological and linguistic richness

Biological diversity refers to the variety of animals, plants, ecosystems, and genes that exist worldwide (CONABIO, 2019). Meanwhile, linguistic diversity or linguistic richness is defined as the number of languages in a given area (Boege, 2008). The relation between bi-

ological wealth and language is very close, it has been proposed that they are related due to the connection (direct, practical, and emotive) that original peoples have with nature (Boege, 1998; Harmon, 2001).

According to Mühlhäusler (1996) and Toledo (in press), modifications in biodiversity and language, act as factors of change one over the other. TEK then represents the formation of the cosmovision as well as encompassing everything a community has learned about their natural surroundings. In other words, it serves as a repository for ecological and cultural knowledge as well as a system of responsibilities, that are transmitted across generations (Harrison, 2007; Whyte, 2013).

Language is the main way to develop, maintain, and transmit TEK among groups of people (Fig. 1), representing the cosmovision of people according to their territories and ecosystems (Boege 1998, 2008). Social factors such as migration, landscape change, species disappearance, or disuse, can affect or influence the transmission of TEK from elders to younger people. This knowledge accumulated over generations can be summarized in specific words.

Figure 1. Fiesta at the Zempoaltépetl; fiestas are a space to transfer knowledge (stories, anecdotes, advices, and reflections), where the language is the main way of transmission. Photo by Alfonsina Arriaga-Jiménez.



Through language, the foundation of culture and knowledge is maintained and transmitted, simultaneously transforming themselves and the ecosystem that surrounds them (Boege 2008; Toledo, 2009). Due to this relation, together with other social aspects, the condition of any of these components will directly affect the stability of the other (Mühlhäusler, 1996; Maffi, 2001). Therefore, both richness are threatened by a multitude of factors and the loss of one can lead to the loss of the other

(Maffi, 2001; Saynes-Vasquez et al., 2013); in addition, forces of colonization, and now globalization are leading many languages to be at risk of disappearing and even dying (Robins, 1991).

Therefore, the “death” of a language or words, represents the extinction of ideas, knowledge, relations with the natural world, and ways of understanding how people live in different contexts.

1.2 Mexico and Oaxaca richness: Languages and species

Mexico is among the countries with the highest biodiversity in the world and is also one of the richest in linguistic diversity with 364 linguistic variants from 68 indigenous linguistic groups (Boege, 2008; INALI, 2019). Despite the disuse and constant marginalization of the indigenous people and their languages, more than 7.5 million people in the country speak an indigenous language, and between 10- 12% percent of the population has a mother tongue different from Spanish (INALI 2008). In Mexico, and Oaxaca in particular, the variety of cultures and ecosystems is mainly due to its complex orography, which provides different visions of understanding and knowledge about nature, as populations adapt to environmental characteristics and transform the landscape through their knowledge (Boege, 2008; CONABIO, 2012).

Oaxaca state is the richest in linguistic and biological diversity in Mexico, with 157 languages and linguistic variants (Toledo, 2009), and more than 35% of plant species and 50% of animal species of the total found in Mexico (WWF, 2018). Within Oaxaca, the Mixe or Ayuujk language has approximately 136,736 speakers, and in Santa María Tlahuitoltepec (the largest Mixe community) 90% of the population speak Mixe, 64% are bilingual in Mixe and Spanish, and 26% monolingual in Mixe (INALI, 2019). According to this information, the Mixe language spoken in Tlahuitoltepec is still in a stage of resistance, though there are different factors that threaten this language (Gutierrez, 2014). Paradoxically, according to Endangered Language Project (2019), the Mixe spoke in this region, known as Southern Highland Mixe, is assessed as in threat of extinction (ELP 2019).

Indigenous languages are geographically linked to ecosystems due to their evolution in certain ecological niches. In this way, languages are the spoken reflection of the way people think regarding the ecosystem, species, and environmental conditions of a place (Boege, 1998). The loss of biological and cultural diversity implies the reduction, not only of the variety that makes Mexico a country so rich and unique but also of the memory

and identity of indigenous peoples (Toledo, 2009). This identity has been developed throughout history, partly to the selection and generation of species through the

domestication of plants and animals, opening a complex co-evolution process between culture and the life that surrounds it (Boege, 2008).

2. Methodology

In order to continue the research question and to know the natural history of Santa María Tlahuitoltepec, as well as document its changes, we have carried out structured and semi-structured interviews with different generational groups in the community, and life stories for the several elders interviewed individually. Our team needed to reflect our areas of research, so we formed an interdisciplinary team (see Harmon, 2001; Maffi, 2001; Boege, 2008; Toledo, 2009) of ecologists, biologists, and a linguist. Gaining trust in indigenous Oaxacan communities is a complex process, with many historical layers that can act as barriers. To help overcome these, we partnered with a member of the community and had a team member live in the community to foster a relationship and facilitate interviews (Yahalom, 2019). A list of animals and plants in the region was not available, therefore we rely on the information obtained by the inhabitants, teachers, and biologists of the community. In addition, information found in bibliography referring to the fauna and flora of the region in a broader sense as Sierra Norte from Oaxaca was used.

2.1 Results: Forgotten songs in the mountain and *milpa*

The green macaw is an emblematic species and has had significant meanings to indigenous cultures in Mexico and Mesoamerica (Navarijo Ornelas, 1999). This species has been associated with fertility, cosmovision, and water (Fig. 2), and was represented in artistic expressions in a variety of places including Guatemala, Belize, and México (Navarijo Ornelas, 1999; 2011).

Figure 2. Fountain of Tlaloc at El Cárcamo del Río Lerma in Mexico City. Photo by Sebastian Pillitteri.



Ka'ux is the Mixe name for the green macaw (*Ara militaris*); but is also the name of a legend about a bird that takes messages to the *King Kondoy* (Fig. 3) to heal people with speech impediments; as well as being the name of a femeníl philharmonic band in Santa María Tlahuitoltepec, Oaxaca. Some people in the community even remember *ka'ux* being used by parents, to describe kids when they are very noisy (*pers. comm.* Hilaria Diaz). In this example, the relation between the loss of species wealth, the loss of culture and the loss of language was documented when it was observed that when a species disappears, the word in the native language and the associated legend begins to disappear to the younger generations (Arriaga-Jiménez *et al.*, 2018).

Figure 3. Mural of *King Kondoy*, “the good god” in Santa María Tlahuitoltepec, where different representations of nature are observed. Photo by Alfonsina Arriaga-Jiménez



Below, we present a series of preliminary results obtained so far, which allow us to show some of the changes in language and cultural wealth observed through different generations.

In addition to ka'ux, who were sometimes shot for damaging the milpa (Arriaga- Jiménez *et al.*, 2018), there are other birds and mammals that have not been seen in many years (Table 1). Some of those animals were abundant in the surrounding landscapes, hunted for sustenance and offerings, but little by little they stopped being seen. The populations of these species have declined, not only because of hunting, but mainly because of changes in land use, deforestation and climatic changes, which are most felt in mountain ecosystems.

Table 1. Animals no longer observed in the community and surroundings

Common and/or scientific name	Name in Mixe
Birds	
mountain pigeon	<i>päk and ku'uk</i>
barn owl	<i>kupajk tut</i>
owl	Kerespu
hawk	Mëejts
acorn woodpecker; <i>Melanerpes formicivorus</i>	<i>Kuutsyaat</i>
peregrine falcon; <i>Falco peregrinus</i>	Äx
quail	<i>kuxo'ok</i>
<i>Campylorhynchus sp</i>	<i>Xëtsy</i>
gray-breasted martin; <i>Progne chalybea</i>	<i>tsek wee'</i>
MAMMALS	
coyote	<i>Wääch</i>
ocelot	<i>wääch muts</i>
fox	<i>wääch tsaps</i>
squirrel	<i>ku'uy</i>
wild rabbit	<i>Këy</i>

As for the plants, some of the more notorious and still used are known by name and other characteristics, as several different “quelites” (edible herbaceous plants e.g. *kupu'uj*, *murtääs*, *tseepiyj*, *ëxmotspatsyj*, *äxkäjeepj*, *xëjk pijj*, *patsi' ipj*, *maatäpj*, *tsäpsiipj*, *pëëptsi' ipj*) and home remedies (*xu'ux pijy*, *tupat*, *nëëkipy*, *nëëtsuuky*, *ka'oxk*, *käë nespaj*, *tuu' paat*, *nee xu'uk*). While others “don't have a name” (pers. comm. inhabitants of Tlahuilottepec), or people stopped using them because they were not very relevant in their daily life. Some others might have a name before, but the disuse of them and their little “relevance” or replacement in the current daily life (e.g. plants used as traditional remedies or soap), causes that the name is now unknown, to disappear from the vocabulary and from the traditional use.

Other case is related with the wealth of the surrounding forest, where 30 years ago people could recognize at least 16 different species of oaks (Oaxaca has the highest diversity in oaks), but now people can see and name just three (pers. comm. Nereyda Pérez).

Also, the partial or non-transmission of TEK, or its erosion, does not only cause the loss of knowledge, but can also change the perception of animals that were once considered as “good”. Two *abuelitas* of the community spoke about two species associated with the harvest of the milpa. One called “*tsuxuk*”, a black arthropod with spots on its “carapace” and red body, and another named “*mojk tsënëny*”, a black with red stripes “reptile”. Neither one of the names were known by younger generations. Further research allows us to identify the “reptile” as the endemic salamander *Isthmura bellii* (Gray, 1850). This species is considered as Vulnerable (IUCN 2016), and its presence indicated a good harvest and corn abundance where it was found (pers. comm. Doña Chave). These two species might act as bioindicators of good soil and humidity that would mean a good harvest of the milpa. However, the next generation does not know this, and because of the colors (red and black) now they might kill the animals because they think it is poisonous (pers. comm. Hilaria & Aureliana).

3. Discussion and further remarks

With these preliminary results, we have collected a set of words that have been forgotten over time, they are an example of the subtle relationships that exist between the connections, similarities, and traits that links nature with humans, which need a much more careful observation through the generations (Harrison, 2007).

Little by little, what does not need to be named stop being heard. When a species goes extinct or is extirpated,

the word that refers to it becomes used only in memories, anecdotes or books. Some words, such as *ka'ux*, are lucky enough to be perpetuated in the name of a band, which will allow those who did not know the word by its original meaning, to know it by its resignification. We still do not know how many more cases like the ones mentioned here exist, not only in Mixe, but in other languages. The loss of words and languages is a gradual process, in which the youngest generations are the first

to not know words, legends, or the symbolic elements associated with them, and the species that refers to. To understand, not just quantify, the impact on local myths, legends, and cultural wealth of a community, it is precise that studies focused on biodiversity loss where an indigenous language is spoken, involve a linguistic and anthropological lens to their research. It is necessary to better understand the behavior of the species as well as the associated impact on indigenous language and cultural wealth.

When research is focused on knowing other ways of living with nature and its elements, specifically if people of the community have been interested in its conservation, the investigation allows other people in other contexts to understand that there are other ways of living and relating with nature.

Regarding species conservation, for over a decade the emphasis has been on having updated information on how many of these are, and their assessments of their vulnerability in Mexico (Toledo, 2013). However, as our research indicates, there is a need for coupling this information with the communities that have the most contact with those species an TEK; both in terms of obtaining the most relevant information, and in terms of creating the best conditions for their conservation. As UNESCO mentioned, indigenous people are the guardians of the biodiversity hotspots, therefore they, their knowledge, and their language should be taking it into account in all conservation projects (see Fig. 4).

Figure 4. poster in the Zempoaltépetl that exemplifies the vision of the ayuujk jä'äy on nature as “that which gives life”. Photo by Melissa Castillo-Ibarra



Although in Mexican legislation all indigenous languages are included as official languages, they are not fully allowed in administrative documents and in public education, becoming “minoritized” languages. Thus, there is always a risk that they can disappear, stopping the transmission of knowledge that has been accumulated and perfected from the beginning of the coexistence of the language with the environment. This process is repeated worldwide, where states usually do not recognize the indigenous languages as transmitters of knowledge, or they are considered as “inferior” knowledge. In many cases even though multilingualism is promoted, conditions are not provided for speakers to develop freely, meaning that the language is recognized but the people who speak it are considered “inferior”, their lands sometimes are taken away, and their fundamental rights are not recognized. Unfortunately, this is a common practice in societies; the dominant group subjugates and marginalizes subordinate groups’ behavior and language (Tatum, 1997).

Even though the Mexican state has a history of suppressing indigenous languages, culture and TEK, there has also been community resistance, which has enabled indigenous languages to continue being spoken. The conservation and documentation of languages has continued thanks to government institutes (e.g. INALI, National Institute of Indigenous Languages), civil organizations (e.g. Cepiadet A.C., Indigenous Professional Center for Defense and Translation Counseling), and communal efforts (e.g. Ayuujk workshop in the Elementary School Pablo L. Sidar in Tlahuitoltepec), but above all thanks to the struggle of indigenous language speakers and communities to continue using their language in different contexts. In fact, the Mixe are known as the unconquered people, because they were never conquered by other indigenous people nor the Spanish Colonizers, “we conserve our identity because we are stubborn people” (*pers. comm.* elders of Tlahuitoltepec). Although some indigenous languages are documented in papers and recordings, it means to keep them static, the use in daily life keeps them alive.

Finally, although there are encouraging steps and actions in the face of the increasing death of languages and the disappearance of species, there is still much work to be done, in order to allow communities to reappropriate their language, their natural resources and their TEK. It requires arduous research work by multiple disciplines that allow us to document, and at the same time implement actions to stop these losses. Once again, it is necessary that not only academics are working on it, but a collaboration in conjunction with the population in general, who must first be sensitized to this problem.

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5. References

- Arriaga-Jiménez A, Pérez- Díaz C. & Pillitteri S. (2018) Ka'ux. Mixe language and biodiversity loss in Oaxaca, Mexico. 8:3, 127-143. *Regions & Cohesion*. doi: 10.3167/reco.2018.080308
- Boege, E. (1998). La cuestión étnica y la antropología social en México: balance y perspectivas. *Cuadernos de la casa chata*, 160, 45-65
- Boege, E. (2008). El patrimonio biocultural de los pueblos indígenas de México: hacia la conservación in situ de la biodiversidad y agrobiodiversidad en los territorios indígenas
- CONABIO. (2012). Comisión Nacional para el conocimiento y uso de la Biodiversidad Retrieved from <https://www.biodiversidad.gob.mx/pais/quees.html>
- CONABIO (2019). Comisión Nacional para el conocimiento y uso de la Biodiversidad Retrieved from https://www.biodiversidad.gob.mx/biodiversidad/que_es
- Crystal, D. (2000) *Language Death*, Cambridge University Press
- ELP- Endangered Language Project (2019) Retrieved from <http://www.endangeredlanguages.com/lang/7590>
- Ethnologue (2018) Retrieved from <https://www.ethnologue.com/>
- Gutierrez, J. (2014) Estructura de la cláusula simple, predicación primaria y predicación secundaria en el mixe de Tlahuitoltepec <https://ciesas.repositorioinstitucional.mx/jspui/bitstream/1015/601/1/TE%20G.D.%202014%20Juan%20Climaco%20Gutierrez%20Diaz.pdf>
- Harmon, D. (2001), “On the Meaning and Moral Implicative of Biodiversity”, en L. Maffi (ed.), *On Biocultural Diversity, Linking Language, Knowledge, and the Environment*, Smithsonian Institution Press, Washington y Londres.
- Harrison, K. (2007). *When languages die*, Oxford University.
- INEGI- Instituto Nacional de Estadística, Geografía e Informática. (2011). *Censo de Población y Vivienda, 2010 (Informe nacional y estatales)*, México. Disponible en: <http://www.censo2010.org.mx>
- INALI (2019) Retrieved from https://site.inali.gob.mx/Micrositios/estadistica_basica/estadisticas2010/pdf/agrupaciones/mixe.pdf
- INALI (2019) Retrieved from <https://www.inali.gob.mx/clin-inali/>
- Llorente-Bousquets, J., y S. Ocegueda. 2008. Estado del conocimiento de la biota, en *Capital natural de México, vol. I: Conocimiento actual de la biodiversidad*. Conabio, México, pp. 283-322.
- Kimmerer, R. W. (2002). Weaving Traditional Ecological Knowledge into Biological Education: A Call to Action, *BioScience*, Volume 52, Issue 5, 1 May 2002, pp. 432–438.
- Maffi, (2001). *On biocultural diversity: Linking language, knowledge and environment*. Knowledge and Environment. Smithsonian Institution Press. Washington and Londres
- Mora C, Tittensor DP, Adl S, Simpson AGB, Worm B. (2011). How Many Species Are There on Earth and in the Ocean?. *PLOS Biology* 9(8): e1001127. <https://doi.org/10.1371/journal.pbio.1001127>
- Llorente-Bousquets, J., y S. Ocegueda. (2008). Estado del conocimiento de la biota, en *Capital natural de México, vol. I: Conocimiento actual de la biodiversidad*. Conabio, México, pp. 283-322.

- https://www.biodiversidad.gob.mx/pais/pdf/CapNat-Mex/Vol%20I/111_Estadoconocimiento.pdf
- Mühlhäusler (1995). On the relationship between linguistics and biological diversity. In: *The politics of multiculturalism in Asia and The Pacific* (ed. D. Myers). Darwin: Darwin University press
- Navarajo Ornelas, M. D. (1999). Análisis de representación faunística en una muestra de vasijas mayas del Clásico, Suplemento del Seminario Permanente de Iconografía, 2: 1-19. México: Instituto Nacional de Antropología e Historia, Dirección de Etnología y Antropología Social.
- Navarajo Ornelas, M. D. (2011). Guacamaya: Símbolo de Temporalidad y Fertilidad. Retrieved February 20, 2019.
- Robins, R. H., & Uhlenbeck, E. M. (1991). *Endangered languages*. Berg Pub Ltd.
- Saynes-Vasquez A, Caballero J, Meave, J., Chiang F. (2013) Cultural change and loss of ethnoecological knowledge among the Isthmus Zapotecs of Mexico, *Journal of Ethnobiology and Ethnomedicine* 2013, 9:40
- Tatum BD (1997) Why are all the black kids sitting together in the cafeteria?
- Toledo, V. M. (2008). ¿Por qué los pueblos indígenas son la memoria de la especie? *Papeles*, 107, 27-38.
- Toledo, V.M. (2009). El metabolismo social: una nueva teoría socioecológica. *Relaciones* 136: 41-71
- Toledo, V.M. In press.
- UNESCO (2019) Retrieved from <https://en.iyil2019.org/>
- Yahalom, J. (2019). *Caring for the People of the Clouds: Aging and Dementia in Oaxaca*. University of Oklahoma Press.
- Whyte Powys, K. (2013). On the role of traditional ecological knowledge as a collaborative concept: a philosophical study. *Ecological Process*. 2:7
- WWF (2018) Retrieved from http://www.wwf.org.mx/que_hacemos/programas/oaxaca/