

Exploring the Role of Ecolinguistics in the Highlands of Peru:
A study on the relationship between the Quechua language
and local agrobiodiversity

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Abstract

Ecological knowledge embedded in indigenous languages is linked with the preservation of biodiversity through sustainable practices. For generations, the traditional practice of preserving agrobiodiversity by indigenous communities has provided them with the ability to identify crop species best suited to varying climatic conditions. As the number of speakers of indigenous languages rapidly declines worldwide, society as a whole risks losing valuable knowledge and potential solutions to climate change-enhanced ecological stressors. This research determines the extent to which a decline in the use of the Quechua language and cultural customs has influenced agricultural practices in Quechua communities of the Peruvian highlands. In tandem, this study works to understand if a shift in Quechua language use affects the traditional practice of maintaining local agrobiodiversity. To determine the relationship between language use and agricultural practices, this study relies on an in-depth analysis of previous research and eight one-on-one interviews conducted virtually. The results of this research indicate that the topic at hand is more complex than originally hypothesized. Several variables besides language use were identified as being influential in the transformation of rural Andean agricultural practices. Understanding the variables causing a decline in agrobiodiversity can assist in identifying methods to best preserve crop diversity, protecting the self-sufficiency of rural communities and global food systems.

Introduction

Indigenous languages possess generations' worth of knowledge particular to their local environment. Knowledge pertaining to the environment, termed *traditional ecological knowledge* (TEK), risks being lost as indigenous languages rapidly decline worldwide (Gafner-Rojas, 2020; Lantz & Turner, 2003). TEK includes adaptation strategies in the face of ecological transformations, making it especially valuable during our current climate crisis (Apgar et al., 2009; Hann et al., 2010; Ogar et al., 2020). One sector of life increasingly threatened by climate change are the world's food systems. Many genetic variations of crop species risk extinction if they cannot adapt to extreme atmospheric change, making crop diversity a significant asset in the face of climate change (Zimmerer et al., 2020).

Agrobiodiversity is defined as “the variety and variability of animals, plants and microorganisms that are used directly or indirectly for food and agriculture” (FAO, 1999). This definition also includes the processes and human activity involved in food production, making local knowledge a fundamental part of agrobiodiversity. In rural Quechua communities that practice subsistence farming, agrobiodiversity provides self-sufficiency in the form of a resilient food system (FAO, 1999; Zimmerer et al., 2020). While a plethora of studies on the connection between indigenous languages and biodiversity exist, research particularly focused on the Quechua language and its relationship to farming and agrobiodiversity in the Peruvian highlands is lacking.

Using this information, I hypothesize that as the number of Quechua speakers decreases, traditional agricultural practices are more prone to modernization, resulting in a loss of agrobiodiversity. To investigate this hypothesis, I first review previous research beginning with an analysis on the concepts of traditional ecological knowledge and the multiple threats to

indigenous languages. I then introduce the value of agrobiodiversity before exploring the history of the Quechuan languages and the evolution of language rights in Peru. Following these reviews, I describe the characteristics of different forms of agriculture with a focus on traditional Quechua farming practices and rituals.

After completing this literature review, I present detailed summaries of each of the eight interviews I conducted virtually. The interviewees included Quechua language instructors in the United States and Peru, two agricultural scientists in Peru, three native Quechua speakers of varying occupations, and a linguist. These interviews clarify the relationship between the variables being studied from a range of perspectives, mostly from individuals experiencing changes first-hand. Due to the number of concurrent variables involved in this study, challenges arise in determining one clear conclusion. A lack of access to reliable language use data and specific data regarding the usage of particular agricultural practices relative to a prior baseline are amongst these challenges. While discerning the suspected pattern poses difficulties, this research still presents valuable insights on the relationship between indigenous language use and agrobiodiversity.

More specifically, this work seeks to determine the degree to which Quechua language use influences the transformation of rural agriculture and agrobiodiversity levels in the Peruvian highlands. This research also attempts to identify other variables besides linguistic interactions that impact traditional agricultural practices. As agrobiodiversity increases the self-sufficiency of rural communities, it is important to identify factors decreasing crop diversity. With this information, the primary causes can be properly addressed to develop ways in which Quechua communities can preserve their self-sufficiency.

This study highlights the acute issues indigenous communities face in our modern world. Despite contributing the least to our current climate crisis, indigenous peoples are burdened with the most immediate consequences (Haan et al., 2010; Magni, 2017). Mountain glaciers are disappearing, threatening the water supply of various communities, including many Quechua communities in the highlands of Peru (Caine, 2019; Maffi & Woodley, 2010). Droughts and frosts are occurring more frequently, threatening the self-sufficiency of farming communities, and the overall predictability of climatic changes have shifted at a rate faster than many can adapt (Zimmerer, 2020). Representing the unique indigenous experience may encourage acknowledgement and inclusion of these groups in the conversation of climate change, allowing for their voices and needs to be heard.

Language Extinction and Biodiversity

I. Threats to Indigenous Languages

Indigenous peoples comprise about five percent of the world's population with an estimated 370 million people, inhabiting about 20 percent of the Earth's land (UN, 2010). Despite native languages making up 71 percent of the world's seven thousand languages, only a minority of the human population speak them; most will no longer be in use by the end of the century (Gafner-Rojas, 2020). One major reason for this loss is suppressive policies restricting the rights of native peoples, including the restriction of linguistic human rights - the right to choose which language to use while interacting with public and private entities. Nations have historically neglected the needs of their indigenous populations by maintaining a monolingual society, minimizing native peoples' access to services such as education, administration, and health care (Skutnabb-Kangas & Phillipson, 1995). A monolingual society can be defined as one where all sectors use a singular, dominant language. In contrast, a multilingual society

acknowledges more than one language as dominant within a country, providing speakers of minority languages with accessibility to public services in their mother tongue (Rousseau & Dargent, 2019).

A common example of the suppression of linguistic human rights appears in the education sector, where speakers of minority languages must often learn a country's dominant language as it is the only language with which to access formal education (Hill, 2013; Howard, 2004; Skutnabb-Kangas & Phillipson, 1995). To indigenous community members perpetually disenfranchised and discriminated against, education often represents social capital for socioeconomic advancement (Rousseau & Dargent, 2019). Pursuing a formal education past the basic level typically requires students to commute or move from the countryside to larger cities. In these urban settings, indigenous students are made to feel ashamed of their identity and fear discrimination from instructors, classmates, and the general public (de la Piedra, 2009; Hill, 2013).

Scholars argue that climate change also contributes to the decline in speakers of indigenous languages. Indigenous populations mostly live in ecosystems of high vulnerability and as climate change progresses, ecological patterns have transformed drastically, resulting in the displacement of native peoples whose livelihoods depend on their land (Magni, 2017). Without living on the land to which they are ancestrally connected, indigenous peoples' social and cultural identities grow threatened (Short, 2010). Historically, indigenous communities have learned to adapt to environmental changes by referring to the traditional generational knowledge woven into their native language. As this knowledge has been developed over hundreds of thousands of years, it has contributed to the successful adaptation of indigenous societies in the

face of ecological changes through and across those prior generations (Apgar et al., 2009; Ogar et al., 2020).

Generational knowledge embedded in linguistics has been termed as “mutual knowledge”: information not solely understood through an interchanging of words but rather constructed and understood through linguistic interactions (Hintz & Hintz, 2017). Linguistic interaction refers to the process which forms language structures. Through conversation, community members share experiences that may confirm or contradict their beliefs, allowing them to continue developing their shared knowledge. These linguistic interactions have provided indigenous communities with a method of adapting their language as their understanding of the natural world changes. In light of climate change increasing ecological and agricultural stressors, preserving the adaptive generational knowledge intertwined with native languages is a crucial conservation tactic (Apgar et al., 2009; Hann et al., 2010; Ogar et al., 2020). One such example from a case study in Canada shows how language-based ecological knowledge of the Eeyou Istchee Cree First Nations people contributes to diversity maintenance of a local migratory fish population (Fraser et al., 2006).

Indigenous groups predominantly inhabit regions rich in biodiversity and have developed relationships and cultural traditions that protect and celebrate this biodiversity (Romaine & Nettle, 2000). The species and natural resources protected by indigenous communities constitute about 80 percent of the biological wealth on this planet (Gafner-Rojas, 2020). This level of maintenance has been possible through language acting as a method of sharing knowledge through generations of people. Researchers have coined the overlap of biological and linguistic diversity as biocultural diversity, where places with a diverse set of languages and cultures coincide with the most biodiverse regions on earth. Indigenous peoples inhabit these regions with

the most linguistic and biological diversity. As each language holds its own set of knowledge, a zone with high linguistic diversity implies a broad, diverse range of knowledge. The presence of such vast knowledge contributes to the thorough maintenance of the local environment, allowing zones rich in linguistic diversity to coincide with biodiversity (Maffi, 2018; Maffi & Woodley, 2010; Romaine & Nettle, 2000).

II. *The Value of Language*

Through interactions with the surrounding environment and other community members, languages evolve over time to incorporate new understandings of the world (Maffi, 2002). In some cases, languages cannot adapt to a changing world and die out through a complete loss of speakers, either by not teaching the following generations or abandoning one language for another. Languages, especially indigenous ones that precede the advent of modernity, possess generations' worth of knowledge on the web of life. These are the languages most in danger by the rapid rate of language death in the modern world (Gafner-Rojas, 2020).

The term *traditional ecological knowledge* (TEK) refers to the collection of wisdom indigenous languages possess, passed down through generations through songs, stories, rituals, and other linguistic interactions (Lantz & Turner, 2003). This knowledge depends heavily on the particular location of any given community, as TEK regards the local environment they have ancestrally depended on (Romaine & Nettle, 2000). An extension of TEK is *traditional phenological knowledge* (TPK) which refers to the seasonal timing of plant and animal life cycles. TPK is specifically used to predict resource availability and changes in weather patterns (Lantz & Turner, 2003).

The management of natural resources by indigenous communities largely depends on the knowledge embedded in their language. Many researchers argue that because indigenous

communities have lived off the land for centuries, they have an incomparable ability to conserve natural resources and protect the environment sustainably (Maffi, 2002; Ogar et al., 2020; Rasmussen & Akulukjuk, 2009; Gafner-Rojas, 2020). It has been argued that the ability of humans to survive previous ice ages and major climatic changes required the very same TEK and indigenous wisdom being lost today (Ogar et al., 2020). Through a loss of native languages, humankind loses complex understandings of the natural world believed to have the capacity to teach us how to adapt to the current climate crisis in ways particularly suited to the local environments indigenous communities inhabit (Apgar et al., 2009). Based on this belief and the advocacy for linguistic human rights, many scholars intensely promote the preservation of indigenous languages before they cease to exist.

Critics of this movement claim that the desire to preserve indigenous languages arises from individuals wanting to restrict native communities from advancing in society by forcing them to practice a language the modern world does not value. Widdowson and Howard (2008) argue that the conservation of traditional languages and practices socially isolates native peoples and prevents them from becoming economically independent. The authors claim that abandoning ancestral customs is necessary for human development and teaching native peoples English or other non-native languages is simply a helpful tool in providing these communities with autonomy. This argument stems from the observation that advocacy for indigenous rights is often guided by non-natives who are present in meetings to serve as interpreters or translators for the dependent native population (Widdowson & Howard, 2008).

Other critics question the connection between biodiversity and languages and cultures. Gavin McNett finds that the linkage between linguistic and biological diversity is simply not concrete enough to be valid (2011). He argues that languages themselves cannot be regarded as

ecological based on the synchronization of endangerment of indigenous languages, flora, and fauna. Scholars of linguistic and biological diversity do not base their argument on the coincidence of endangerment but by the fact that through close interactions with their local environment over generations, indigenous peoples have developed a rich fortune of ecological knowledge, allowing for sustainable conservation of their natural resources. Through this conservation, indigenous communities have been able to rely on natural resources for their survival while allowing biodiversity and species richness to thrive (Gafner-Rojas, 2020; Ogar et al., 2020; Rasmussen & Akulukjuk, 2009).

III. The Value of Agrobiodiversity

The United Nations Food and Agriculture Organization (FAO) defines agrobiodiversity as “The variety and variability of animals, plants and microorganisms that are used directly or indirectly for food and agriculture, including crops, livestock, forestry and fisheries” (FAO, 1999). This definition includes the genetic diversity of the crops, human activity, and other elements involved in the farming process. Supporting agrobiodiversity provides benefits to the nutrient content of a field, increases overall productivity, and improves the quality of soil and groundwater (Bioversity International, 2019). Cultivating a diverse range of products with a variety of inputs also helps reduce the risk of major crop losses caused by extreme climatic conditions, pests, and other abiotic or biotic stressors. While some species may not be able to withstand sudden changes in the environment, other more resilient species can survive, preventing a community or individual farmer from losing their food source (FAO, 1999; Haan et al., 2010; Zimmermer et al., 2020).

Maintaining agricultural biodiversity in a particular field can be considered a form of traditional agriculture (Singh & Singh, 2017). Through the use of various methods to cultivate a

large assortment of products and the saving of seeds from genetically diverse crops, indigenous communities have been promoting agrobiodiversity for centuries. The Peruvian highlands are recognized as having the highest intra- and inter-specific agrobiodiversity across the globe, all due to the practices involved in the region's traditional agriculture, rooted in respect for the natural environment (Bioversity International, 2019; Maffi & Woodley, 2010). The cultivated fields of peasant communities, largely including Quechua-speaking communities, contribute directly to the preservation of our planet's crop diversity, especially regarding the potato with over 3,000 genetic varieties (Sayre et al., 2017).

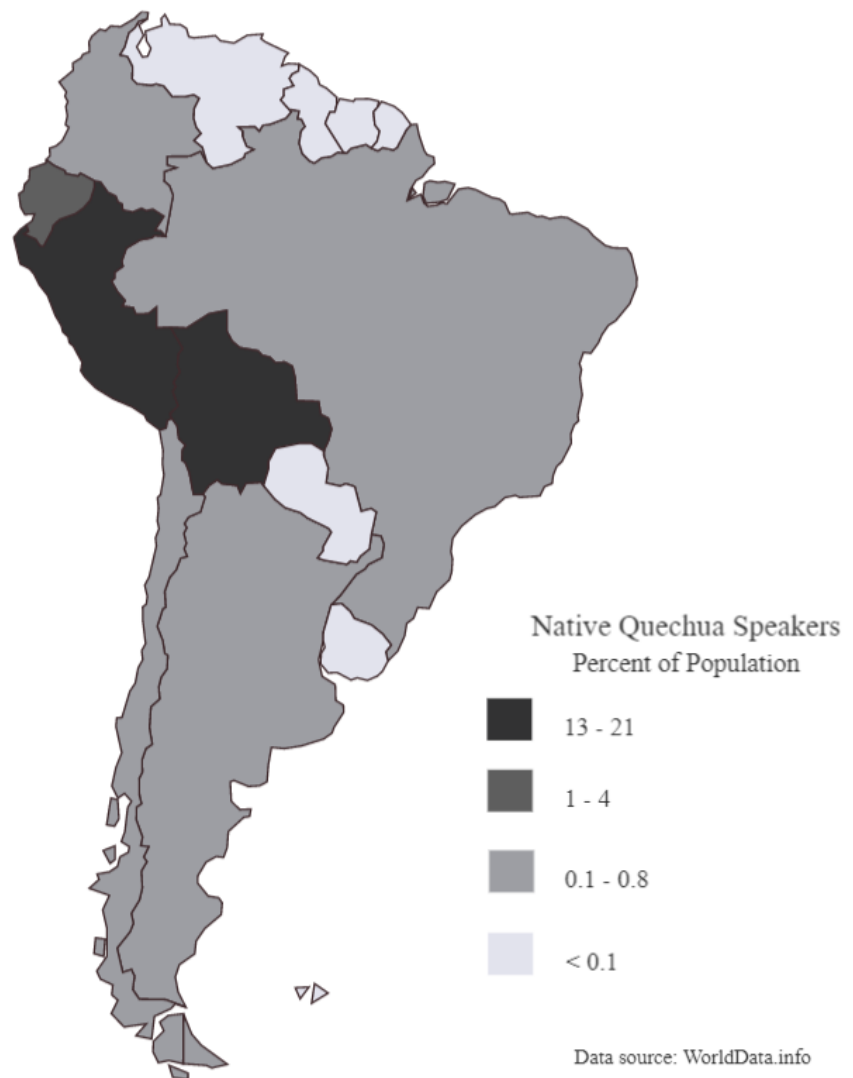
Currently, the pressure to commercialize Quechua farms threatens agrobiodiversity as well as the traditional knowledge that accompanies this practice. Farmers hear that if they replace their native crops with genetically modified "improved" varieties, they can make a profit, essentially exchanging tradition for increased income (Maffi & Woodley, 2010). Despite this threat, agrobiodiversity remains protected by unswayed farmers, organizations, and several governments' genetic resource management seed banks (Bioversity International, 2019). The preservation of agrobiodiversity contributes to the global need to identify resilient crop varieties in the face of climate change and provide individual farmers with food sovereignty (Zimmerer et al., 2020). In the case of rural Peru, where Quechua farmers relay their values, traditional agricultural practices, and ecological knowledge through dialogue in their native language, what will happen to this wealth of crop diversity as the number of Quechua speakers decreases?

IV. The Quechuan Languages

Several dialects exist within the Quechua language family; it has been identified as the native language with the most speakers in the Americas, existing most prevalently in Peru, Ecuador, and Bolivia (Hornberger & Molina, 2004). In Peru alone, over ten percent of the

population speaks Quechua as their first language (Linares, 2017; Urban, 2019). *Figure 1* provides a visual representation for the percentage of native Quechua speakers in South American countries.

Figure 1: Percentage of native Quechua speakers by country



During the Spanish colonization of South America, Quechua was recognized as the lingua franca, or common language, of the region (Durston, 2007; Mannheim, 1984). Today, although Quechua has between eight to twelve million speakers, the language is in decline and considered to be endangered (Hornberger & Molina, 2004). An endangered language can be

defined as one at risk of disappearing through the process of losing native speakers who may adopt other languages. Especially in the case of indigenous languages that possess an incredible wealth of ecological and general knowledge, this endangered status may result in losing hundreds of thousands of years of intellectual discoveries (Apgar et al., 2009; Maffi, 2002; Romaine & Nettle, 2000; Shepherd, 2010).

During the 1980s, linguist Rosaleen Howard conducted a sociolinguistic study in rural Peru on a particular Quechua dialect, and found that bilingual Quechua children who favor speaking Spanish identified elements in their local environment exclusively in their native language. This was not caused by a preferential choice of language but by the fact that no Spanish translations exist for a vast majority of ecological Quechua vocabulary (Howard, 2004). Quechua communities are primarily agricultural and the Andes is a region where several crop species originated and exist in large genetic varieties (Haan et al., 2010). These findings and the possible correlation between native languages and biodiversity inspired me to research the degree to which Quechua language use impacts traditional agricultural practices and the diversity of Andean crops in the Peruvian highlands.

V. The Evolution of Quechua Language Rights in Peru

According to the 2017 census of Peru, 14 percent of the population aged five and up speak Quechua as a first language. Despite the Peruvian government recognizing Quechua as an official language of the country in 1975, the majority of social services remained exclusively accessible in Spanish until more recently. This means that members of society who only spoke Quechua could not easily interact in their mother tongue with major public institutions such as those in the fields of health, education, and policy. In 2011 Peru, Law 29735 was passed by the first group of Quechua Congresswomen, prohibiting regions with a majority of native language

speakers from providing services exclusively in Spanish. Currently, ordinances exist across the country requiring schools to teach Quechua at least at the basic level and the state highly encourages public servants to be bilingual (Rousseau & Dargent, 2019).

Despite efforts to promote the linguistic rights of Peru's Quechua population, marginalization persists. Quechua continues to be viewed as a backwards language, associated with illiteracy and a low socioeconomic status (Hornberger & Molina, 2004). In response, rural communities recognize education as the gateway to upwards social mobility, allowing them to pursue careers beyond farming. This influences parents to urge their children to seek a formal education and practice Spanish more than Quechua to break the generational cycle of their rural lifestyle (Howard, 2004; Hornberger & Molina, 2004). While seeking a higher education in metropolitan areas, Quechua-speaking students must deal with discrimination and micro-aggressions from both teachers and peers (Hill, 2013; Huayhua, 2016; de la Piedra, 2009). This kind of ill social treatment further reinforces the rejection of the Quechua language and culture in favor of the respected, dominant Spanish language. As time progresses, younger generations speak less and less Quechua, contributing to a decrease in the number of speakers of the language (Howard, 2004).

VI. Traditional Agriculture and Agricultural Rituals in the Peruvian Highlands

When considering the topic of agriculture, one can imagine farming practices to fall primarily into one of two categories: traditional or industrial. Traditional agriculture refers to processes that rely on human and animal labor, simple tools and machines, natural fertilizers, crop diversity, and local knowledge (Singh & Singh, 2017). Typically, traditional agriculture refers to subsistence or small-scale farming. Instead of being stagnant, traditional agriculture

evolves over time, using local knowledge and ecological changes to innovate technologies and practices (Maffi, 2018).

Oppositely, industrial agriculture requires an extremely large area of land, the use of fossil-fuel powered machinery, chemical inputs, homogeneity, and minimal manual labor (Romaine & Nettle, 2000; Singh & Singh, 2017). The input of chemical fertilizers and heavy machinery required to boost crop yields contribute to environmental degradation in the forms of soil damage and water and air pollution (Singh & Singh, 2017). As a system that focuses on growing monocultures of one particular genetic variety of a crop in excessive amounts, industrial agriculture contributes to biodiversity loss. Considering that certain species may not be able to adapt to our quickly changing climate, a loss of crop diversity threatens the survival of our current food system (Shepherd, 2010).

The Andes region hosts a variety of native crops for which Quechua communities have been farming for generations (Haan et al., 2010). In Peru, 19 percent of land area is dedicated to agriculture, accounting for 28 percent of the country's employment (Bioversity International, 2019). Peru's most popular native crop is the potato, with over 3,000 genetic varieties existing in the country alone (Sayre et al., 2017). Most crops native to Peru are tubers and grains such as oca, yucca, quinoa, maize, kiwicha, and cassava (Camino & Johns, 1988; Sayre et al., 2017; Shepherd, 2010). For the past 8,000 years, farmers in the Andes have successfully cultivated these native crops. The agricultural knowledge related to such practices has been passed on over generations through the indigenous Quechua language, incorporating adaptation strategies in the face of extreme climatic conditions (Sayre et al., 2017).

Passing down this valuable knowledge can occur through its incorporation in beliefs, rituals, and other customary practices (Lantz & Turner, 2003; Maffi & Woodley, 2010). Concepts

of traditional practices reflect the Andean Quechua philosophy of respect for others and Pachamama, or mother earth, who encompasses all living things and other elements of the local environment (Swiderska & Stenner, 2020). The holistic Andean definition of community believes in nourishing the “reciprocal relationships between the various elements of the landscape” (Sayre et al., 2017). This reciprocity is satisfied when a harmonious balance exists between all living and non-living members of the community and natural world.

The reciprocal principle that Quechua communities live by is called *ayni*. *Ayni* not only refers to an innate connection between all of the living and spiritual beings of a community, but most frequently to the non-monetary exchange of services and resources (Apgar et al., 2009; Hill, 2013; Sayre et al., 2017). An example of the practice of *ayni* can be found in traditional barter markets, where rural indigenous communities from various altitudes exchange produce and other resources without monetary transactions (Swiderska & Stenner, 2020). Within individual communities, *ayni* may be expressed through families taking turns providing agricultural labor to their neighbors as well as sharing seeds, tools, and knowledge (Sayre et al., 2017).

Because the traditional Andean philosophy of holistic reciprocity arises from respect for every entity in the surrounding environment, Quechua communities customarily practice rituals to express gratitude to the spirits of the natural world. The *Apus*, or mountain gods, are believed to dictate changes in weather and are responsible for the success of certain crops (Swiderska & Stenner, 2020). If praised, the *Apus* can protect animals and humans from misfortune. When disrespected, the *Apus* may do the opposite and cause damage by releasing hail, thunder, and lightning (Caine, 2019). To ensure a good harvest and protection from hostile environmental phenomena, Quechua customs have included offerings to the spirits of the earth and to the

ancestors. Most rituals incorporate the South American native coca leaf in some capacity, whether by being chewed, becoming an ingredient in a drink, being blown over, or reading a message from the leaf (de la Piedra, 2009; Swiderska & Stenner, 2020).

Although these conversations between Quechua communities and the environment have become far less practiced, they once were believed to comprise the ultimate form of ensuring the survival of their crops and the stability of their climate. The prioritization of financial wellbeing and the introduction of Catholic religions in some Quechua communities are attributed to play a role in the declining practice of traditional rituals. There is some correlation with language, as well, as the younger generations who do not experience rituals at the same rate as previous generations cannot recognize vocabulary associated with specific spirits and practices, while also being unable to recognize their ancestral value (Caine, 2019).

Beyond spiritual practices connected to Quechuan traditional agriculture, the communities express respect for the environment through the choices made for physically treating the land. Since prehispanic times, the farmers of the Andean region relied on natural resources to create fertilizers. Quechua farmers have and continue to rely on cattle manure and green manure from local plants to enhance growth on their farms and gardens (Camino & Johns, 1988). Customarily, farmers apply manure to the soil either before or after it is plowed with the chaquitacla, the Quechua foot plow. While chemical fertilizers pollute the soil and can cause algae blooms in local waterways, the use of natural fertilizers helps to recycle nutrients in the soil without introducing them in excess amounts (Singh & Singh, 2017).

Traditional Quechua agriculture also involves listening to and reading the land. Terraced agricultural zones play different roles depending on their altitude (Swiderska & Stenner, 2020). The highest altitude can reach 5,000 meters and is typically reserved for llama and alpaca

grazing land. At lower altitudes, a variety of crops can be cultivated, traditionally in patterns where the land is used for two to four years and left fallow for another two to four years (Camino & Johns, 1988). Referring back to the concept of *ayni*, this reciprocal practice usefully allows communities from different altitudes to share crops with each other that cannot be grown at their respective locations (Swiderska & Stenner, 2020).

To leave soil fallow for years, Quechua farmers have a rotation system that involves multiple farmers within a community to combine their fields into one particular sector. By aggregating potato fields specifically, Quechua farmers have been able to reduce the density of pests affecting their crop. This practice not only protects the soil and the crop, but increases the biodiversity of crops within a field by combining seeds from several families (Soroush et al., 2011). The spatial arrangement of crops and effect of aggregating fields works to combat abiotic stressors aside from pests such as harsh temperatures (Haan et al., 2010). The spiritual and physical practices involved in traditional Quechua agriculture to understand when, where, and how to cultivate native crops is an example of the traditional phenological knowledge embedded in the Quechua language and passed down through generations (Lantz & Turner, 2003).

Methods

Study Site

Given that this study centers around agrobiodiversity, Peru was selected for having the second highest score for overall agrobiodiversity compared to other countries (Biodiversity International, 2019). Peru also contains the largest population of native Quechua speakers in the Andes region (Hornberger & Molina, 2004). Observations were not limited to a particular region but instead aimed to understand the research question in a larger context. While results from census data and literature review came from a variety of sources, interviews emphasized Cusco,

Cajamarca, and their surrounding areas. Investigating a diverse selection of sites allowed a more widespread understanding of the interactions between the Quechua language and culture and agrobiodiversity.

Analysis of Literature

Much of this study relied on an in-depth analysis of scholarly literature that dissects topics of linguistics, agriculture, and biodiversity in rural communities of the Peruvian highlands. This includes articles, journals, and books. Publications released by organizations working with indigenous communities to promote linguistic and biological diversity were also analyzed. This analysis served the purpose of examining and identifying the connections between the factors being studied to confirm the strength of the relationship between them.

Interviews

A total of eight interviews were conducted over Zoom with American and Peruvian scholars, native Quechua speakers, agricultural scientists in Peru, and Quechua language instructors in Peru and the United States to obtain a better understanding of what the language use and agricultural practices look like in real time. My thesis advisor recommended about half of the interviewees. My subsequent network of interviewees expanded by asking the initial interviewees for recommendations on who else to speak with as well as reaching out to authors of scholarly publications. The focus on these interviews varied based on participant backgrounds with the objective of understanding the topic of this study through several points of view including those experiencing the changes studied first-hand.

To structure my interviews, I turned to chapter 11 in the *Handbook of Methods in Cultural Anthropology* published in 2014 (Weller). The purpose of the interviews was to collect observations, opinions, and specific information about agrobiodiversity and the Quechua

language. These kinds of questions fall under the category of classification and belief studies, which does not require recoding or scoring of responses (Weller, 2014). Instead, these kinds of studies present interviewees with open-ended questions whose responses can be summarized without exact transcriptions being necessary.

To accurately assess beliefs, I repeated questions in the same format and level of difficulty for each participant. Interview questions approximated grand tour questions and taxonomic questions. Grand tour questions ask for a description of a process or place in a way that encourages a broad review of a subject matter (Weller, 2014). Taxonomic questions attempt to identify and categorize items in question by function or attributes, such as asking an interviewee to list the kinds of native crops they encounter in their daily life (Spradley, 1979).

Most interviews flowed like conversations guided by a selection of questions. I began each interview with open-ended questions and moved on to more specific questions as the interview progressed. The more general questions gave me an insight into how participants viewed the topics at hand without being entirely influenced by the relationships implied to exist in my more specific questions. The questions included here are listed in the order they were asked. Overlaps occurred in the kinds of questions asked but the categories were generally separated as follows:

I. Questions for scholars and agricultural experts in Peru

- With a reduction in the use of Quechua, have you noticed specific, correlated changes in the agricultural sector?
- What are the most significant changes following a reduction in the use of traditional agricultural practices?

- As agricultural practices continue to modernize, much of the Quechua-speaking youth are unable to recognize certain vocabulary specific to traditional farming tools. Do you find this to have an effect on the biodiversity of crops? Or are these changes only impacting the farming process?
- How has the increase of monocultures influenced the cultural practices of the Quechua?
- Many people believe the process of modernization should not occur out of fear of losing indigenous culture. Others believe these modern changes allow indigenous communities more time to partake in other activities. What is your opinion on the transition from traditional to modern agricultural practices?
- What has been the most significant consequence of former Peruvian President Fujimori's land reform of the 1990s that divided communal Quechua land for private property ownership? Did anything positive come from this change?

II. Questions for native Quechua speakers

- Have you noticed an increase or decrease in the amount of Quechua heard in public spaces?
- Where do you hear Quechua spoken the most?
- How often do you speak Quechua? Do you see value in maintaining proficiency in your native language?
- What does the Quechua language and culture mean to you?
- What do you believe to be the most effective way to protect the Quechua language and culture?

III. Questions for Peruvian Quechua instructor

- What elements of life have been most affected by a reduction in the number of Quechua speakers?
- Are you aware of any changes in campesino farming related to a reduction in the use of Quechua?
- What change has teaching Quechua made for indigenous communities and Peruvian society as a whole?
- Who are the people you are teaching? Are they mostly people living in the city of Cajamarca or do you work in rural areas as well?
- Considering that so many people fear discrimination based on speaking Quechua, what has been the most effective way of promoting the revitalization of Quechua to your students?

IV. Questions for non-Peruvian scholars studying biocultural and biolinguistic diversity

- What do you believe to be the main factor in the reduction of agrobiodiversity for indigenous communities?
- Do you think there is a way to preserve ancestral values of life while embracing certain aspects of modernity? If so, what do you imagine this to look like?
- What do you believe to be the most effective way of ensuring the protection of the cultural traditions, languages, and needs of indigenous communities while still protecting their autonomy?
- During any one of your studies, have you directly observed an ecological consequence as a result of a community losing their language or having less speakers of a particular language? What has been the most significant evidence for this phenomenon?

- I'm sure you have learned an incredible wealth of knowledge through working with indigenous communities and other individuals passionate about these topics. What are some of the most meaningful things you have learned from these experiences? Were there particular interactions that made you rethink your approach to promoting an appreciation for our world's biocultural diversity?

Results

The results section presents data collected from each of the eight interviews. *Table 1* introduces the interview participants, their backgrounds, and a shortened version of the major findings from the interviews. Themes from each interview will be discussed in-depth in this section following the table below.

Table 1: Interview participants and most significant findings

Date	Pseudonym	Occupation	Main Takeaway
9/13/21	Clarisa Diaz	Native Quechua speaker and professor of Quechua language at a major US university	Policies can be made to support two seemingly separate causes at the same time. The current Peruvian government is improving child nutrition while reforming the agrarian sector by implementing a program where Quechua farmers are being paid to provide some of their crops to children in need. Plus, some Quechua words related to agriculture <i>are</i> actively disappearing.
9/22/21	Dr. Isabela Calderon	Professor of agriculture at a major university in Cusco, Peru	Money is a significant motivator for straying from tradition especially for families who wish to send their children to the city for more opportunities. Industrial agriculture may be less efficient in the Peruvian highlands due to their

			specificity for flat land, not terraced land. For this reason, much of the industrial technologies damage the soil, impacting the self-sufficiency of these communities.
10/5/21	Natalia Lopez	Archeologist in Cusco, Peru and native Quechua speaker	The COVID-19 pandemic has resulted in many members of the Quechua youth to move back to the countryside, away from large cities that are suffering high unemployment rates. It's interesting to consider what this will mean for the Quechua language at large. Will people reconnect with their heritage and language and choose not to move back to the city when employment rates are more stable?
10/13/21	Dr. Diego Fonseca	Agricultural scientist and professor at a major university in Cusco, Peru who works with native communities to preserve the biodiversity of Andean crops	Dr. Fonseca believes that a reduction in the use of Quechua will not affect crop diversity. Potato varieties have always been written in and referred to in Quechua, not Spanish, and there is now a movement to keep these names as such. Rural education includes agricultural education and holistic Andean values; children are taught to value the local flora & biodiversity.
12/16/21	Dr. Ruth Moore	Linguist, author, and professor of English Language at a major university in England	The concept of enhancing tradition by incorporating it with modern technologies is especially useful during our climate crisis where the environment may be changing faster than communities are able to adapt.
1/31/22	Emilio Cruz	Quechua language instructor in Cajamarca, Peru and native Quechua speaker	Despite what they have been told for generations, Quechua-speakers <i>can</i> access opportunities for societal and economic advancement without abandoning their native language.

2/7/22	Alfonso Quispe	Miner in Potosi, Bolivia and native Quechua speaker	Some rituals and traditional agriculture continue to be practiced in rural Quechua-speaking communities. Straying from traditional farming methods is primarily caused by farmers wanting to sell more product, requiring a large amount of farming land that would be too difficult and time-consuming to tend to manually.
2/8/22	Liliana Suyana	Peruvian weaver and native Quechua speaker	Reliance on native crops and traditional farming practices is much more common than mechanized farming in rural areas and for small-scale agriculture in general. The COVID-19 pandemic has played a role in encouraging the younger generations to practice their native language.

I. Lecturer of Quechua at Major US University

Clarisa Diaz, a native Quechua speaker born in Peru, currently teaches the Quechua language at a major public university in the United States. We centered the beginning of our conversation around the Quechua culture of agriculture. Clarisa shared with me that for Quechua communities, potatoes are not simply a crop they cultivate; they are entities that people identify with. Each of the many varieties of potato has its own Quechua name, history, and persona. Potato varieties are planted in their plots in a particular order for the most efficient harvest. For example, potatoes most resilient to cold temperatures are planted on the perimeter of plots, protecting the varieties more sensitive to the cold. Each plot is used for three years before leaving the land to rest for five years.

The Quechua social structure is based on agriculture and is incredibly communal. Families help each other with their farms and livestock and payments are often transferred in the

form of favors. Clarisa spoke to me about how this way of life was threatened in the 1990s by the Peruvian President Fujimori, who split up communal land in favor of individual property ownership. This decision resulted in a more distant Quechua community as individual families were able to harvest on their own land and sell their products on their own accord. Constructing a more individualistic society would make it easier for the government to encourage the production of monocultures for profit.

Related to gaining a profit, many families and individual community members move to the city of Lima and other metropolitan areas in search of employment. With many members of the younger generation moving to the city, fewer people are practicing traditional agriculture. Clarisa briefly taught me about certain elements present in traditional Quechua agriculture, one of which being the ritual of having cantoras¹ present while farmers plant new crops. During the planting process, the cantoras sing songs relating to the process to bless the growing season. Tractors and other modern farming technologies are replacing traditional farming tools. Clarisa shared with me that children no longer recognize traditional agricultural tools by name or appearance. This is resulting in a disappearance of words related to agriculture. The most recognizable tool still used today is the chakitaqlla².

The current Peruvian government is making efforts to revitalize the culture and spirit of the Quechua and other indigenous groups. Clarisa states that the shame surrounding the Quechua language has drastically declined compared to the 1990s and the younger generations are more inclined to speak Quechua than before. With the second agrarian reform occurring in the present day, farming is more encouraged through programs whereby the government will buy crops from campesino³ farmers to provide to children in need with the goal of improving their nutrition.

¹ Cantoras : female singers

² Chakitaqlla : foot plow

³ Campesino : peasant; often used to refer to native communities living on their ancestral land

II. Professor of Agriculture and Biodiversity

Dr. Isabela Calderon is a professor of agricultural topics and biodiversity at a major university in Cusco, Peru. We jumped right into a conversation about the cross-over between agrobiodiversity and language. When I asked if she thought that the disappearance of Quechua words related to agriculture were impacting agrobiodiversity, Dr. Calderon stated that the main cause for a reduction in agrobiodiversity is the tendency for parents wanting to provide more for their families. When children move to the city, the financial demands are high enough to influence families to grow commercialized monocultures of GMO crops. This pull toward monocultures mostly happens in communities close to the city where traveling to the markets to sell crops is feasible. Regarding language, Dr. Calderon shared that children who leave their communities to move to the city continue to speak Quechua unless they choose to settle there. Typically, the second generation of those who settle no longer practice Quechua.

Oftentimes, people criticize the transition from traditional to modern agricultural practices in fear that a valuable piece of cultural heritage is being lost. Dr. Calderon finds that the most detrimental consequence of modernization in the agricultural sector is not a loss of culture but a reduction in the self-sufficiency of indigenous communities. As she explained, traditional agricultural practices are adapted to the local environment. Modern farming technology is constructed for flat land, not the particular terraced highlands of Peru. The use of these industrial technologies on non-flat land damages the soil, consequently damaging the community's food sovereignty.

Dr. Calderon disagrees with the common statement that modern farming technologies save farmers time and money. Traditional practices may immediately be more time-consuming but when considering the damage caused by chemical inputs and improper technologies, modern

practices end up costing communities more. Plus, there's the feat of transporting these large machinery through the highlands of Peru.

Lastly, we shifted our conversation to the agrarian reform during Fujimori's presidency where communal farming land was split up for private property ownership. Some families sold their farming land instead of utilizing it for its original purpose. Similar to my meeting with Clarisa, Dr. Calderon believes that the most harmful consequence of this government action was how it impacted the sense of community for the Quechua, whose societies practice Ayni⁴ philosophy. Ayni translates to cooperation in Quechua and refers to the belief system by which the community profits not off a salary, but off communal work where each day, a different field is tended to. People are paid in livelihood and favors, not money. Replacing communal land with private property introduced the opportunity for farmers to make a profit off of their products, often resulting in the farming of monocultures and genetically modified crops as they are more profitable. This transition results in a decrease in agrobiodiversity. Farms are also less productive as genetically modified crops are not specifically adapted to the local environment in the way that native crops are, making the use of chemical fertilizers necessary.

III. Cusco Archaeologist

Natalia Lopez was born and raised in Peru with Quechua as her first language. Currently, she is an archaeologist in Cusco, Peru. We began our conversation by speaking about the Quechua language itself. Natalia explained that despite her being fluent in both Quechua and Spanish, her daughters are only fluent in Spanish with limited abilities in the native language. Whenever given the chance, Natalia elects to speak in Quechua as she prefers it to Spanish, stating that "hablar Quechua es tan dulce"⁵. Whether completing fieldwork, speaking with

⁴ Ayni : cooperation; today for you, tomorrow for me

⁵ Hablar Quechua es tan dulce : Speaking Quechua is so sweet / rich

coworkers, or shopping at markets, Natalia speaks as much Quechua as possible. Fortunately for her, the current Peruvian government's advocacy for bi-literacy has created a language dynamic in the country where Quechua and Spanish are both frequently encountered and beginning to blend.

Despite Quechua being more present in Peruvian society than during previous presidencies, Natalia clarifies that Quechua is barely heard while in big cities like Lima. In contrast, Quechua dominates in markets and fairs. Natalia acknowledges that the number of speakers of Quechua has decreased but the current promotion for bi-literacy has comforted her that the language can be revived or at least increasingly integrated in Peruvian society.

Regarding the agricultural sector, Natalia states that farming practices have not changed much in response to shifting linguistic dynamics. What has been affected most in the agricultural sector by community members moving away from Quechua has been the labor. In our modernizing world, the younger generation of Quechua communities are drawn and often encouraged to move to the city in pursuit of opportunities that can improve their socioeconomic status. In doing so, they lose the ability to assist their parents on the farm, causing them to take on more physical labor than would happen if their children were available. This can result in lower productivity and increased pressure on the older generation to contribute to their community.

Interestingly, the COVID-19 pandemic has reversed this trend. With the pandemic, unemployment rates increased, leaving many of the Quechua youth in the city without work. Where once the younger generation moved to metropolitan areas in search of opportunities, the consequences of the pandemic have urged many to move back to their communities. This migration trend has helped revive the cultural traditions of Quechua communities as families

reunited and returned to the farms. While speaking on this topic, Natalia stated that this trend could easily switch back to how things were before the COVID-19 pandemic, with many members of the younger generation moving back to the city. Considering the fluidity of the present situation, Natalia believes it is important to recover the agricultural sector in a sure, long-lasting way.

To end our conversation, I asked Natalia what she believes to be the most effective way of preserving the Quechua language and culture. Her response was simple: conserve what we have and teach the next generation.

IV. Professor of Agricultural Sciences

Dr. Diego Foneseca is a professor in the agricultural sciences department of a major university in Cusco, Peru. He specializes in the biodiversity of Andean crops and often works with campesino communities on their farms. I first asked him about the connection between language and agriculture by questioning if he has noticed the diversity of crops to be affected by a change in the use of Quechua. While he acknowledges that the number of Quechua speakers has decreased drastically in the past few decades, he does not believe this loss of language will have a major impact on the biodiversity of Andean crops. Dr. Fonseca gave several reasons for this thought-process with the primary one being that learning about the local ecology and agriculture is a major part of rural Quechua education. Communities teach children early on to value biodiversity, native plants, and the local environment along with appreciating the holistic belief that all plants and animals have the right to live. To Dr. Fonseca, biodiversity conservation is not being threatened by a reduction in the use of the Quechua language as learning of its value is a fundamental aspect of their learning curriculum.

Pieces of Quechua appear outside of rural communities in reference to agriculture. Dr. Fonseca shared that potato varieties have always been written and referred to in Quechua, not Spanish. Currently, a movement exists to keep the names of potatoes in Quechua instead of shifting to Spanish names. Support of this movement makes Dr. Fonseca feel as though the connection between Andean crops and Quechua is strengthening, not worsening. Additionally, there are Quechua terms for every characteristic and detail of the potato including its anatomical features. The botanical terminology developed in Quechua is incredibly specific and includes references to agricultural practices, making it much more expansive than the taxonomy created in Spanish-speaking countries and the United States.

While on the topic of the United States, we began speaking about how much more industrialized the agriculture sector is compared to traditional Quechua agriculture. The US is dominated by industrial agriculture composed of monocultures, genetically modified crops, heavy machinery, chemical inputs, and fossil fuel energy inputs. In Peru, modernization is causing similar agricultural changes. To increase profits, many farmers are switching to monocultures of commercialized crops, causing a decrease in agrobiodiversity. The use of industrial technologies like tractors are also more common now. Dr. Fonseca finds the modernization of the agricultural sector to be more responsible than shifting linguistic dynamics in reducing the biodiversity of Andean crops.

V. Professor and Researcher of Linguistics

Dr. Ruth Moore, a linguist, researcher, and professor of English language at a major university in England, became intrigued by the topic of language endangerment by focusing on the concept of linguistic diversity loss. Through becoming knowledgeable on the process by which one language spreads at the expense of another, Dr. Moore became passionate about the

threat of indigenous language endangerment. In pursuit of her passion, Dr. Moore studied in Papua New Guinea where she witnessed detrimental effects on the environment after an abandonment of traditional language use and ecological practices. Dr. Moore has not specifically studied agrobiodiversity, the Quechua experience in Peru, or other native South American communities.

In one of her research studies focusing on the connection between linguistic and biological diversity, Dr. Moore wrote that one of the two waves of change in the human environment that have endangered the most languages is the development of agriculture. As I have found in my research on Quechua, agriculture and food are the primary preservers of the native language as rural farming broadly relies on traditional practices, street markets are filled with Quechua dialogue, potato names are in Quechua, and weaved goods rely on native crops. So, how can agriculture perpetrate change when it also preserves tradition and language? According to Dr. Moore, her statement referenced how agriculture is a primary tool that *can* be utilized to endanger languages. Farming initially gave communities more autonomy in their habits of consumption. Instead of solely relying on hunting and gathering, people were able to cultivate their own food and discover efficient ways of doing so. The ability to expand agriculture gave communities the ability to grow and trade, spreading their language at much greater speeds than could be done by smaller hunter-gatherer societies.

Dr. Moore and I spoke about the criticism that promoting the preservation of indigenous languages is a disguised effort to keep communities in poverty. When considering this critique, Dr. Moore explained what she believes to be a false dichotomy between indigenous practices and poverty. Critics often view the effort to preserve native languages and cultural traditions as an attempt to restrict these communities to a lower socioeconomic status. Dr. Moore argues that the

goal of indigenous language preservation is to protect the cultural heritage of communities. In no way does she believe that indigenous communities should be sheltered in the past. In fact, she favors a reality where communities can have a balance between tradition and modernity; where tradition can be enhanced by modern technologies. Dr. Moore wishes to encourage bilingualism and biculturalism while also preserving native languages; they are not separate beliefs.

To complete our interview, I asked Dr. Moore if she could offer any advice on highlighting the importance of linguistic diversity to society at large. She emphasized that this topic is not one that has a zero-sum game. In promoting linguistic diversity, we must embrace elements of the modern world while studying the value of historical knowledge. To emphasize the value of this topic, Dr. Moore recommended a focus on the positive effects of communities reclaiming their culture by incorporating success stories where social and ecological improvements were made. To her, the presence of preserving traditional knowledge as a top goal on the UN agenda is a statement in itself of the value in native language protection.

VI. Native Quechua Speaker and Language Instructor

Emilio Cruz is a native Quechua speaker on a mission to revitalize the fading language. He grew up in a rural village in the highlands of Porcón, Peru, northwest of the city of Cajamarca where he currently resides. Emilio was primarily raised by his grandparents who were monolingual Quechua speakers, particularly of the northern dialect. His father spoke both Quechua and Spanish but due to the marginalization associated with being Quechua, Emilio's father tried his best to mostly speak to him in Spanish. This is a recurring theme in Peru, where parents often separate their children from their native language and culture for the sake of improving accessibility to opportunities for societal and economic advancement.

The beginning of our interview focused on Emilio's experience growing up Quechua and how he became a teacher of the language. He began attending primary school around age seven, at which point he had no choice but to learn Spanish as the curriculum was exclusively provided in this language. This is a shared experience for Quechua-speaking children who become exposed to Spanish through their educators and often begin to favor it to their native language. There are several reasons for the younger generation to favor Spanish, the root of which being the perceived value of Spanish in comparison to Quechua. Emilio explained that many view Quechua as a limiting factor that restricts communities from advancing in society or making a stable income. Quechua-speakers are discriminated against and ridiculed for their heritage by individuals in society as well as government entities. Even the educators in rural settings will shame children for speaking Quechua, referring to it as a "savage indian language". The younger generation frequently regards Quechua as an ancient language with no value in today's world of constant modernization. As these children grow up, these dynamics pressure them to abandon their language and move to metropolitan areas, pursuing educational and professional opportunities not limited to farming.

While many of his peers intended to push away from their shared cultural heritage, Emilio felt moved to preserve it. He was incredibly close to his grandparents who taught him to appreciate Quechua instead of falling victim to a homogenizing society. When he completed secondary school at the age of sixteen, Emilio began to pursue a career in teaching the native language by studying linguistics. His grandfather would regularly share stories with him in Quechua and urge him to write them all down to preserve their cultural heritage and language. Emilio has published six books in his mother tongue including Quechua dictionaries, fictional stories, and pages filled with jokes and banter.

To get a better understanding of who feels motivated to learn Quechua in the present day, I asked Emilio to describe his average student. He claims that most of his students are mestizos⁶, or of mixed descent, from the city. A part of this may be because certain professional positions now require at least some understanding of Quechua. For example, Peru's department of agriculture requires some Quechua-speaking ability as the job often includes working with rural farming communities. In Cajamarca, employees who can speak Quechua are preferred, including for positions as translators in the medical and judicial fields. While society aims to convince Quechua communities that they cannot advance in society without embracing the colonial Spanish language, it's interesting that there are several establishments actively seeking employees not limited to the Spanish language.

When asked if he ever has native speakers or people from rural areas as students, Emilio expressed that this hardly ever occurs and he believes it to be a problem. With the pattern of community members moving back and forth between the city and campo⁷, their ability to speak Quechua becomes at least moderately impaired. So while non-native speakers are starting to learn Quechua, young native speakers are slowly losing their Quechua literacy and not seeking to re-learn it as they don't perceive it to have a high societal value.

We then shifted our conversation to agriculture. When asked about changes in the agricultural sector related to a reduction in the use of Quechua, Emilio explained that modernization has been changing the values associated with farming. Large machinery such as tractors are replacing traditional tools like the ox plow. As more industrial technologies are introduced, traditional ones become obsolete, resulting in people no longer recognizing certain vocabulary related to agriculture. The process of farming itself has changed as well. Emilio

⁶ Mestizo : an individual of mixed Spanish and indigenous descent

⁷ Campo : countryside

pointed out that traditionally, Quechua farmers planned their cultivation around the lunar calendar, a custom rapidly being lost. Industrial agriculture also introduces the use of fertilizers and insecticides, two chemical inputs that damage the soil and the crops cultivated on it. Emilio finds this to be an illustration of how different the values associated with farming have become. Where traditional farming honored the land as its own respected, living entity, industrial agriculture has normalized polluting the land with toxins. Simply put, as the farming process modernizes, related Quechua values and words are lost. Coinciding with a change in the traditional values of agriculture, there has been an increase in the number of Quechua natives working in mines as its economic value is greater than farming.

We ended our interview with a conversation on what could be done to effectively promote the revitalization of Quechua amidst the fear of being discriminated against. Emilio believes there should be increased efforts to make the language more present in society and in online contexts. To him, acknowledgement and appreciation are the two greatest tools for encouraging people to embrace their cultural heritage instead of feeling forced to abandon it.

VII. Native Quechua Miner

Alfonso Quispe works in the dangerous mines of Potosi, Bolivia and is a native Quechua speaker. While Alfonso is bilingual in Quechua and Spanish, his mother is a monolingual Quechua speaker. Our meeting focused on the role of Quechua in his life. Like Peru, the country of Bolivia has three official languages, two of which are native. These are Quechua, Aymara, and Spanish. According to Alfonso, provinces and rural towns are mostly fluent in Quechua while Spanish speakers dominate larger cities. In the mining town of Potosi where he resides, Quechua can be heard much more than Spanish.

When asked about how often he speaks Quechua, Alfonso explained that he speaks it almost daily. Alfonso visits his mother two to three times a week and only speaks to her in Quechua. He lives with his younger sister and they speak to each other in Spanish. When Alfonso goes to work in the mines, he speaks Quechua with his coworkers, mostly native Quechua speakers like him. He claims that about 90 percent of the miners in Potosi speak Quechua and at times, they'll speak a blend of Quechua and Spanish in the mines that they've labeled as Quechuañol. Since many people switch between the two languages in their daily lives, Alfonso finds that some have lost proficiency in Quechua. He blames this partially on the education system where in rural areas, schooling is not provided past the basic level. If one would like to pursue further education, they would have to migrate to the city where Quechua-speakers are frequently discriminated against. This discrimination and the derogatory language accompanied with it often make Quechua speakers feel ashamed and less encouraged to speak their native language to avoid marginalization.

We spoke briefly about agriculture and Alfonso shared with me that his family has their own plot that he visits frequently. They grow many native crops including maiz, potatoes, and chuño, a freeze-dried potato product. While some provinces have experienced modernization in their agricultural sector, Alfonso's region still practices traditional, manual agriculture. He shared that for the most part, heavy machinery like tractors are almost exclusively used on farms that produce high amounts of crops for commercial purposes. For farmers practicing subsistence farming, manual labor is more common. Where Alfonso's family farms in Potosi, they continue to use the ox plow and other traditional tools. They also still incorporate traditional seeding rituals to bless the season's harvest. The particular ritual they continue to practice is called a

fogata⁸, where offerings are collected and burned for Pachamama⁹, or mother earth. Rituals are also practiced in the mines that are believed to be ruled by a devil referred to as El Tio¹⁰, who will protect the lives of the miners if provided with the sacrifice of a llama.

Our conversation was wrapped up with a question on what could be done to effectively protect the Quechua language and culture. Alfonso believes that incorporating more Quechua in school would be incredibly beneficial. While there are currently legal efforts in place to promote the dominant native languages, Alfonso finds that it is not enough. The school teachings do not provide students with an in-depth proficiency in Quechua nor do they emphasize its value. Alfonso is proud of his ancestral heritage. To him, it's vital to know where we come from and preserve the ways of those who came before us. He describes Quechua as a beautiful language with a rich history that deserves to have its significance recognized.

VIII. Native Quechua Weaver

In the highlands of Peru at an altitude above 3,000 meters lives Liliana Suyana, a native Quechua speaker and weaver of textile goods. She represents the first bilingual generation in her family as her mother, grandparents, and predecessors are all monolingual Quechua speakers. Like Liliana, her children are bilingual in Quechua and Spanish. Her rural community offers school teachings to children in both languages, including the provision of textbooks written in both Quechua and Spanish. Liliana does not think the Quechua language is being lost, especially considering current legal efforts to promote it.

⁸ Fogata : translates to bonfire. Refers to a traditional farming ritual where offerings are collected and burned for Pachamama to bless the seasons harvest

⁹ Pachamama : "Earth Mother" goddess of Incan mythology. She is believed to embody every natural being from the mountains to the water to the sun and moon. Pachamama is also a fertility goddess with power over the planting and harvesting processes.

¹⁰ El Tio : translates to the uncle and is revered as the "Lord of the Underworld" in the Cerro Rico mines in Potosi, Bolivia. Statues of El Tio can be found in every mine in this region and miners leave offerings such as cigarettes and coca leaves as they believe they must keep him fed so he can spare their lives. Sacrificial rituals include slaughtering a llama right outside of the mine and smearing its blood over the entrance.

Specifically in Cusco, a regional ordinance requires schools to teach students how to read, write, and speak Quechua. Similar ordinances have been passed across the country. Liliana believes the best way to prevent language loss is to prepare and teach the next generation, who are often bilingual and less encouraged to speak Quechua. Due to the COVID-19 pandemic, children and the younger generation are spending much more time at home with their families, requiring them to practice their native language.

The practice of weaving textile goods has been passed on to Liliana through generations. Liliana shares that her grandmother and grandaunt taught her how to weave, allowing this vibrant ancestral tradition to continue. Prior to the pandemic, Liliana would work with other women in her community and beyond to do weaving demonstrations. The grand majority of women producing weaved textile goods are native Quechua speakers, also practicing a tradition passed on by their ancestors. To create colorful dyes for her weaving fibers, Liliana depends on native plants, flowers, and cochineal, a small insect found on plants in warm areas. She explained that some of the native plants she uses to create her dyes are gathered from the environment while others she cultivates herself. To collect cochineal, Liliana travels about an hour to a lower altitude where temperatures are warmer. Different color dyes are created by mixing combinations of the natural goods collected.

We then moved our conversation to the topic of agriculture. Liliana has a plot of land where she grows crops for her and her family to consume. They grow a diverse variety of native tuber crops and beans including potatoes, yucca, oca, peas, fava beans, wheat, and other grains. Liliana explained that she still practices traditional, manual farming. She hardly ever uses chemical insecticides and fertilizers on her crops as Liliana almost exclusively prepares her own natural fertilizer either out of composted natural materials or cattle manure. I asked if industrial

agriculture was becoming more common than traditional farming, to which Liliana responded with a simple answer: it depends on the size of the farm. Farmers cultivating on land of four or more hectares for commercial purposes do rely on industrial farming practices, simply because it would be impossible to yield a productive harvest on such an expansive amount of land through manual farming. Farmers of this caliber utilize chemical inputs on their fields to ensure better productivity. They also rely on heavy machinery like tractors to prepare the soil and seeding process.

Liliana explained that in some cases of smaller plots, farmers will use tractors to prepare the soil while manually completing the rest of the farming process, including seeding. Where Liliana lives, ox plows are still used to prepare the soil instead of switching to tractors. Some regions cannot implement mechanized farming due to the terrain. For example, in extremely mountainous areas, neither tractors nor ox plows can be transported, leaving communities in these areas no option but to farm entirely by hand. Subsistence farmers who only intend to grow enough crops to feed their family hardly use chemical fertilizers.

I asked Liliana if she practices traditional seeding rituals, to which she described a ritual she does every single time she prepares a new harvest. The ritual involves creating a drink called chicha made with yellow corn that is fermented over a three-day period. After planting seeds, the drink and coca leaves are poured over the soil while expressing gratitude to the spirits of the earth. Liliana described it as “*invitando la tierra*”¹¹ for the spirits to bless the harvest. Her grandparents showed her how to call to the *Apus*¹² as a form of protecting the harvest from natural harm such as snow, frost, and hail. To Liliana, practicing this ancestral expression of gratitude to the earth is a necessary step in the agricultural process.

¹¹ *Invitando la tierra* : inviting the Earth

¹² *Apus* : the spirit of the mountains in Inca religion

Discussion

Shifting patterns in agricultural practices and the diversity of crops depend on multiple interrelated factors beyond language use. My interviews revealed that agricultural practices shift largely due to aspects of modernity. The introduction of industrial technologies, the commercialization of certain crops, the desire for a life beyond farming, and policy changes: these appear more responsible for a transformation of the agricultural sector than a reduction in the number of Quechua speakers. Each interviewee, except for one, acknowledged a significant threat of language loss to Quechua. The implications of this language loss varied per person, however.

While I hypothesized that indigenous language loss would be a major contributing factor to the evolution of agrobiodiversity in the highlands of Peru, most interviewees attributed this change more directly to modernization and the desire to seek opportunities for socioeconomic advancement. Out of eight interviewees, half (I, II, III, VI) claimed that when the younger generation of Quechua community members move to metropolitan areas to pursue further education or employment, older individuals have fewer hands to work on the farm. Less help on the farm leads to the older generation having a heavier burden of work, reducing farm efficiency. Meanwhile, those same elders seek to support their children from afar. These factors tend to sway Quechua farmers to start growing commercialized monocultures of crops for profit, reducing the crop diversity overall. This may only be possible in communities fairly close to a city market.

Respondents also claimed the introduction of industrial technologies to threaten traditional agriculture and the diversity of Andean crops. Two individuals (VII & VIII) stated that modern farming technology has only reached large commercial farms, not the more common

family or community farms. This response may reflect that both individuals live in extremely rural areas, while other interviewees who have come across industrial farming technologies inhabit semi-populated or densely populated regions. Nearly half the interviewees mentioned that industrial technologies have not been seen in high frequency in the highlands of Peru due to the difficulty of transporting such large machinery through mountainous terrain. I believe this to relate to my previous point that rural areas may not encounter as many modern technologies due to their location in hard to reach landscapes. Extremely rural communities are far from markets, have a reduced population to feed, and may be situated in challenging terrain. I argue that these factors combine to result in industrial farming technologies being unnecessary, hence why they are not regularly encountered by the interviewees who found these technologies rare.

In contrast, more than half the interviewees (I, II, III, IV, VI) did perceive themselves as encountering the spread of industrial technologies fairly often. Industrial technology here includes heavy machinery, chemical inputs such as fertilizers, monocultures, and modified crop varieties. To most, these agricultural elements meaningfully alter the way Quechua peoples farm. One consequence of replacing traditional tools with modern technology has been members of the younger generation becoming unable to recognize certain vocabulary related to agriculture. Two interviewees (I, VI) referenced this language loss as coinciding with a shift in Quechua values. They believe that by losing the vocabulary related to traditional tools and practices, Quechua farmers are losing their ancestral respect for the land woven into their language. This change in values and respect for the earth has justified pollution of soil with chemical fertilizers and soil damage by heavy machinery.

One interviewee (IV) in particular argues that Quechua values related to agriculture are *not* being lost, as community members still learn from a young age to appreciate life of all forms.

The value of biodiversity, native crops, and the local environment are emphasized in early childhood, causing this interviewee to believe that the traditional value of protecting the diversity of native crops will persist, regardless of language use. This presents an interesting contrast to the previously mentioned belief that language, values, and actual practices are significantly influential to each other. Interviewees I and VI perceive a feedback loop where modernization of agriculture causes a loss of Quechua vocabulary recognition, shifting the Quechua belief system, thereby further increasing the presence of modern agricultural practices. In contrast, interviewee IV believes that modernization in the agricultural sector will not increase as a result of the loss of Quechua vocabulary, as he believes the values associated with farming are not exclusively bound to the Quechua language. Instead, he believes the perseverance of traditional farming values and practices in Quechua communities are reliant on educating community members, regardless of the language they are taught in.

Respondents identified policy changes as another major contributing factor to the modernization of the agricultural sector and language use. Interviewees I and II spoke about how the government's splitting of communal Quechua farming land in the 1990s affected their values. While Quechua communities have followed the reciprocal principle of Ayni for generations, making exchanges without monetary transactions, having individual ownership of land opened the opportunity for making a profit from their products. Some farmers began incorporating commercial crops into their plots while others went so far as to sell the plot itself for money.

Regarding language use, interviewee VIII finds that the introduction of regional ordinances requiring schools to teach in both Spanish and Quechua indicates that the native language is not being lost, but reinvigorated. In contrast, two interviewees (VI & VII) feel less optimistic about the inclusion of Quechua in schools. They believe that it may be a step in the

right direction, but the schools do not teach in-depth proficiency in Quechua. They deduce this has resulted in a widespread lack of proficiency in Quechua, especially in native speakers who regularly move between mostly Spanish-speaking metropolitan areas and mostly Quechua or bilingual rural communities.

One topic nearly every interviewee agreed on is the diversity of Andean crops. Several crops native to the Andes exist in hundreds of genetic varieties valued not only by farmers and members of the population but by local and national governments. Several laws protecting agrobiodiversity exist, as well as seed banks for genetic resource management (Bioversity International, 2019). Interviewees VII and VIII (who have their own plot to farm) shared that they grow a diverse set of native crops manually with the inclusion of rituals to bless the harvest. These two participants claimed agricultural practices and the level of agrobiodiversity were not changing too much. Out of the eight people I interviewed, they were the only native Quechua speakers still living in a rural area and the only ones who did not encounter industrial technologies at the same rate as others. While not one interviewee saw changing linguistic dynamics as the reason for a transformation of the agricultural sector, I find it interesting that the only individuals who participate in the most traditional farming practices are the ones living in predominantly Quechua-speaking areas. This indicates a correlation between the two variables despite there being no causal relationship.

Conclusion

Studying the connection between traditional ecological knowledge embedded in indigenous languages and the maintenance of agrobiodiversity has important implications for identifying practices best suited for our current climate crisis. Studies by Gafner-Rojas (2020), Magni (2017), Ogar et al. (2020), Sayre et al. (2017) and Zimmerer et al. (2020) indicated that

genetic variation in crop species strengthens the resilience of the world's food systems, preventing extreme climatic conditions from eradicating the entirety of our food supply. As agriculture rapidly undergoes modernization, monocultures are becoming more widespread, decreasing the diversity of crops. Understanding the extent to which indigenous language use plays a part in this process may indicate the level of urgency related to preserving native tongues.

My hypothesis that indigenous language use would play a leading role in the transition from traditional to industrial agricultural practices was not fully supported by my research. The issue at hand turned out to be much more complex than I had presumed, as I did not consider the role of economics and policy. While there is support for a correlation between indigenous languages and the traditional agricultural practice of maintaining the diversity of crops, direct causation was not found. Quechua-speaking communities abandon tradition more so as a result of seeking socioeconomic advancement in the form of education and employment in Spanish-speaking cities. Agrobiodiversity dwindles as a result of the introduction of modern farming technologies, which is often provoked by the previous consideration. While both of these variables are associated with a change in language use, linguistic interactions are not the primary drivers of change.

With this new information, we can give proper consideration to the methods in which we can preserve agrobiodiversity. Reducing the diversity of Andean crops has the consequence of diminishing the self-sufficiency of farming communities (Magni, 2017; Shepherd, 2010; Singh & Singh, 2017; Zimmerer, 2020). Introducing heavy machinery into the highlands of Peru results in environmental degradation, reducing the quality of crops and the productivity of the farm overall (Singh & Singh, 2017; Shepherd, 2010; Sayre et al., 2017). Just as policy and economics proved to be the perpetrators of change, they have the potential to offer a solution. In order to

maintain agrobiodiversity on Andean farms, the Peruvian government should make efforts to provide farmers of diverse native crops with subsidies to allow them to make a profit off their crop without damaging the local environment with monocultures of commercial crops. Similar programs are currently in place but more awareness is needed to make them widely beneficial (IFAD, n.d.).

Study Limitations and Future Research

Due to the ongoing COVID-19 pandemic, traveling to Peru to directly observe and interact with the communities involved in my research was not a possibility. The distance between the populations being studied and myself means that any information relayed through interviews cannot be confirmed through direct observation. Not being physically present also complicates the ability to form relationships with locals in order to gain their trust which may influence the level of comfort in sharing information during interviews. While I am fluent in Spanish, the information gained through interviews may be slightly skewed due to translations requiring some level of personal interpretation in terms of word choice. This may result in understanding connections differently than the interviewee intended. Related to this limitation, interviews with bilingual Quechua speakers may be skewed as the interviewee may be unable to use a Quechua word for which there is no accurate Spanish translation to provide me with.

To circumvent establishing a concrete causal relationship between the few variables studied, the research does not intend to claim that language and culture are the only factors impacting agrobiodiversity for Quechua-speaking communities. It instead aims to determine if and the extent to which cultural changes impact local agrobiodiversity. Regarding the applicability of the results of this study, there are challenges. This study focuses on Quechua in the Peruvian Andes. The cultural and agricultural practices of indigenous communities are

specific to the geographical and climatic conditions they inhabit. This means that although a connection between indigenous language, culture, biodiversity, and agriculture can be confirmed to exist generally, the extent to which these factors depend on each other will likely differ across communities.

This study only begins to investigate the variables influencing agricultural practices in the Peruvian highlands. My conclusion relies entirely on an analysis of previous research and personal interviews conducted virtually. To further understand the current representation of agrobiodiversity in Quechua communities warrants a closer look at the exact kinds of native crops and their numbers on various community farms. Being able to travel to Peru and make direct observations on the diversity of crops and the actual farming practices being utilized in various Quechua communities would allow for a more accurate insight into the current state of their food systems. Being present would also offer the opportunity to observe how or if language relates to the variation in farming practices and crop diversity across Quechua communities. Particularly beneficial to this study would be identifying a couple of rural Quechua farms and comparing their agrobiodiversity with a commercial farm, while taking into account the languages used on these fields.

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