



Insight

Oral history and traditional ecological knowledge in social innovation and smallholder sovereignty: a case study of erva-mate in Southern Brazil

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ABSTRACT. We outline preliminary results of an ongoing research project conducted in collaboration with traditional erva-mate (yerba mate) producers in Southern Paraná and Northern Santa Catarina, Brazil. The multidisciplinary project includes researchers in the natural and social sciences, forest engineers, historians, rural outreach workers, and farmers and is the result of a long-term engagement with smallholder erva-mate producers. Previous research on forest conservation and use in the region had highlighted the important role smallholder farmers play in maintaining forest cover, but knowledge about how farmers and their families perceive traditional erva-mate production systems and understand their environment were needed. Taking a participatory action research approach, our goal is to work with communities to cocreate and share knowledge, ensuring that the research is based on collectively defined goals. Herein, we focus on some of the major themes identified through oral history interviews, particularly in terms of tensions between smallholder farmers and legal frameworks, as well as insecurity in terms of the continuation of traditional, agroecological practices and their importance for the forest. The project aims to engage a range of stakeholders and actors and incorporate a variety of perspectives in understanding forest conservation through use in agroforestry and agroecological systems, particularly in terms of erva-mate production.

Key Words: *agroecology; agroforestry; Brazil; environmental oral history; forest conservation; nature-based solutions; participatory action research; yerba mate*

INTRODUCTION

Rural communities in Southern Brazil face several major challenges including poverty, loss of skills and traditional knowledge, as well as the impacts of climate change and other forms of environmental degradation (Sambuichi et al. 2017). One of the key factors influencing this situation is the industrial agribusiness complex, which has brought about land concentration and large-scale conversion of forests for monocultures and livestock, which in turn are linked to the deterioration of agricultural ecosystems and biodiversity (Nicholls and Altieri 2019) and the contamination of soil and water (FAO and ITPS 2015). As a result, agricultural ecosystems are becoming more vulnerable to climate change that threatens food sovereignty, and smallholder livelihoods are disproportionately affected (Nicholls and Altieri 2019). In Brazil, more than 50% of the produce consumed by humans for food (including beans, manioc, pork, and milk) comes from small-scale family farmers (Rocha et al. 2012) whose properties are generally less than 50 ha. Although these farms represent 82% of the agricultural establishments in the country, they occupy only 13% of the rural land area (Oxfam Brasil 2016). These producers are important in meeting the zero hunger and other UN sustainable development goals, including clean water, combating climate change, sustainable communities, and life on Earth (United Nations 2019), not only because they produce much of the food consumed in the country, but also because of their potential role as guardians of agroecosystem and forest biodiversity, which are substantially represented on their properties.

Agroecology is a multifaceted practice, science, and movement that not only applies “ecological science to the study, design and management of sustainable agriculture,” but also “aims to create diversified agro-ecosystems, mimicking natural systems as closely as possible to enhance sustainable production and self-reliance”

(FAO 2018:vii). Because agroecological approaches look beyond environmental and agricultural perspectives to include social and social-ecological considerations, they are increasingly seen as alternatives to address the challenges facing food systems (Sinclair et al. 2019). In Brazil, the National Policy of Agroecology and Organic Production (*Política Nacional de Agroecologia e Produção Orgânica*; Sambuichi et al. 2017) highlights the importance of agroecological practices in the current agricultural context. In 2008, Brazil became the world’s largest consumer market of pesticides surpassing the United States, even though studies show herbicide use in certain foods up to 200 times greater than the levels accepted in the European Union (i.e., for soy beans, accepted residue levels of glyphosate are 0.05 mg/kg in the EU, yet in Brazil they are 10 mg/kg; Bombardi 2017) and the occurrence of pesticide residues not authorized for consumption (Carneiro et al. 2015). Since 2019, an unprecedented number of new agrochemicals have been approved for use (Damasio 2019), further exacerbating the situation. Sambuichi et al. (2017:12-13) stressed that “In addition to posing a threat to public health, [pesticide use] can have a serious impact on the environment and biodiversity, resulting in the loss of important ecosystem services” and this model of modernization “has been profoundly unfair for traditional populations that reside in the countryside and the forest, depriving them of their autonomy and the economic and socio-political conditions necessary to maintain their territories, their culture and their way of life.”

Food systems can be vehicles to care for the environment and foster greater social justice through the transformation of production, distribution, and consumption technologies and practices (Blay-Palmer et al. 2016). They can contribute to the diversification and strengthening of local economies through new trade patterns and can promote the dignity, empowerment, and well-being of the community by creating opportunities for

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transformational learning, relationship building, and collective action (Blay-Palmer et al. 2013). Also noteworthy are the ways in which food systems can serve as a catalyst to transform the relationship between humans and natural resources, re-evaluating traditional knowledge and challenging gender inequalities. For example, agroecological and agroforestry systems include a range of technologies that contribute to climate change adaptation and mitigation (Sinclair et al. 2019). Many of these technologies are based on traditional and indigenous knowledge and social and environmental innovation (IAASTD 2009). As Persson et al. (2018) pointed out, “small-scale farming in particular...is still based largely on knowledge acquired through practical experience, and some of the most sustainable farming systems in the world are entirely based on knowledge and practices acquired through the practical experience of generations of farmers.”

In Southern Brazil, one traditional agroforestry system that has developed over generations is the production of *erva-mate* (*Ilex paraguariensis*), a system that has its roots in the cultural practices of the Guarani indigenous people (Nimmo and Nogueira 2019). Upon the arrival of the Spanish in the 16th century in the La Plata River Basin, the colonists quickly assimilated this cultural practice and appropriated the techniques of harvesting and processing the leaves of the tree for commercial gain, with *erva-mate* becoming one of the most important economic drivers in colonial Paraguay, Argentina, and later in Southern Brazil (Folch 2010). Today, the consumption of *erva-mate* as *chimarrão* (i.e., drinking an infusion of the leaves through a metal straw from a gourd) has been transformed and personified as indicative of the gaucho culture of Argentina, Uruguay, Paraguay, and Southern Brazil. As a shade tolerant species, *erva-mate* develops well in the understory environment of the Araucaria Forest, a forest type typical of the highlands of the region (legally recognized as the Atlantic Forest biome), and is often cultivated without chemical inputs because of its natural interactions with the forest environment (Chaimsohn and Souza 2013).

Over the past 30 years, developments in *erva-mate* cultivation, including seedling production techniques, monoculture planting, and genetic improvement, have put pressure on producers to “improve” and intensify production through homogenization (Chaimsohn and Souza 2013). Despite this increasing pressure, traditional *erva-mate* producers in the Center-South and South of Paraná and Northern Santa Catarina (Fig. 1) still largely maintain the agroforestry systems in which *erva-mate* has been cultivated for generations. It is no coincidence, therefore, that although the region has undergone significant anthropogenic interventions in the last century, which have resulted in a drastic reduction in the original forest cover (Castella and Brites 2004, Vibrans et al. 2012), it is precisely in this region where patches of forest are still found (Lacerda 2016, Lacerda et al. 2020). These systems occur mainly on small family farms where agroforestry systems are integrated with a variety of food crops and other nontimber forest products, including *erva-mate*, native fruits, corn, beans, rice, and vegetables, as well as pigs, cattle, and chickens.

Maintaining forest cover is a key aspect of these agroforestry systems, particularly in terms of *erva-mate* production because the species naturally grows well in the forest understory (Oliveira and Rotta 1985), and shaded conditions tend to produce a product

of better quality, i.e., less bitter and with greater leaf area (Marques 2014). Forests are not only important for the properties themselves because they protect local biodiversity (e.g., by providing natural pest control), but also offer other ecosystem services, including the availability of clean water and air, climate regulation, among others (Hauer 2009, Marques 2014, Lacerda et al. 2020). Traditional *erva-mate* systems have a wide diversity of forest species that ensure nutrient cycling (Ilany et al. 2010) and maintaining forests helps mitigate climate shocks such as extreme temperatures, as well as assisting in regulating water cycles during times of water stress or excessive rainfall (HLPE 2017, FAO 2019). In addition, the diversity of plant and animal species that are supported by these agroecosystems is essential to ensure these species’ continuity because inherent genetic variability allows species to adapt to changing environmental conditions (HLPE 2017).

Fig. 1. Map of Southern Brazil showing municipalities in which oral history interviews were conducted. The green circle represents the general region in which traditional *erva-mate* production systems continue on small-scale farms.



A major challenge in the development, establishment, and continuation of sustainable and agroecological activities in Brazil is the lack of knowledge and appreciation regarding the productive traditions and their respective cultural activities (Toledo and Barrera-Bassols 2009, Marques 2014). Despite their importance, there is little recognition of the central role that smallholders and traditional agroecological systems play environmentally, culturally, or socioeconomically in the region (Carneiro and Maluf 2005, Hauer 2009). Research and outreach programs maintain a top-down knowledge paradigm that alienates small producers and ignores the importance of working with producers to develop systems that address local realities (Hauer 2009, Alves et al. 2010). Despite being a pillar of the agroecological movement (Sambuichi et al. 2017), this process of creating and disseminating knowledge in partnership with farmers is poorly developed in outreach and research practices.

In this context, our ongoing project was developed to create a knowledge network about agroforestry and agroecological

practices, particularly in terms of erva-mate production, which values and gives voice to rural families and documents and disseminates their stories and understandings of the forest, food security, local culture, and biological heritage. Our multidisciplinary team involves researchers and outreach officers from federal (Embrapa Forestry), state (Agronomic Institute of Paraná IAPAR; State University of Ponta Grossa, UEPG) and municipal (Secretaries of Agriculture) institutions, and community partners including representatives of the Family Farmers' Union (FETRAF) and smallholder farming families across seven municipalities in Southern Paraná and Northern Santa Catarina States (Fig. 1). Across our research partnership, we are integrating technical analysis with knowledge documentation and the cocreation of knowledge to develop innovative approaches to address a wide range of issues identified by the community, including the development of community-based sustainability indicators, the assessment of ecosystem services, the maintenance of forest biodiversity, and engaging women and youth. One of the key methodological approaches has been the incorporation of oral history interviews as a means to document and cocreate knowledge with our community partners. This approach enables us to integrate a plurality of methods and perspectives to better understand the "ecosystem across multiple scales in time and space" and begin to deconstruct the dominant view of a landscape and peoples' interactions with it (Arce-Nazario 2007:119). We present two key preliminary themes identified through our oral history interviews and discuss the ways in which our project is leveraging this knowledge to inform policies and practices that support the continuation of traditional erva-mate agroforestry systems in the region.

METHODS

Methods such as interviews, focus groups, and participatory art projects have been used in conservation and environmental research to better understand how landscape change is perceived and the social-political implications of participants' experiences (Persson et al. 2018). Williams and Riley (2020:225) argued that "oral history as a practice can lend itself to more participatory research, which challenges the barriers between 'expert' and 'lay' knowledge, as well as gaps between research and application." Oral history interviews offer a unique perspective on issues of the environment, forests, and conservation because they provide an understanding of the ways people produce meaning of the places they inhabit, and how they perceive and value the natural world around them (Williams and Riley 2020). They also enable the emergence of environmental subjectivities, or the lived experience and myriad contexts of that experience, including environmental, physical, cultural, historical, and political. Environmental subjectivities can "address the formation process of how individuals construct and reconstruct a set of discursive relationships with 'nature'" (Zhang 2019:489) and recognize that the "boundaries between the 'self' and the environment are porous, and that human subjectivity is shaped by a human being's engagement with its total environment, not just its social environment" (Singh 2013:191). The registering of this multitude of subjectivities during field work relied on interviews mediated by the participation of farmers, technicians, and other actors within these social processes, who also acted in this context as researchers, incorporating various points of view brought about by their lived realities. In taking this methodological approach,

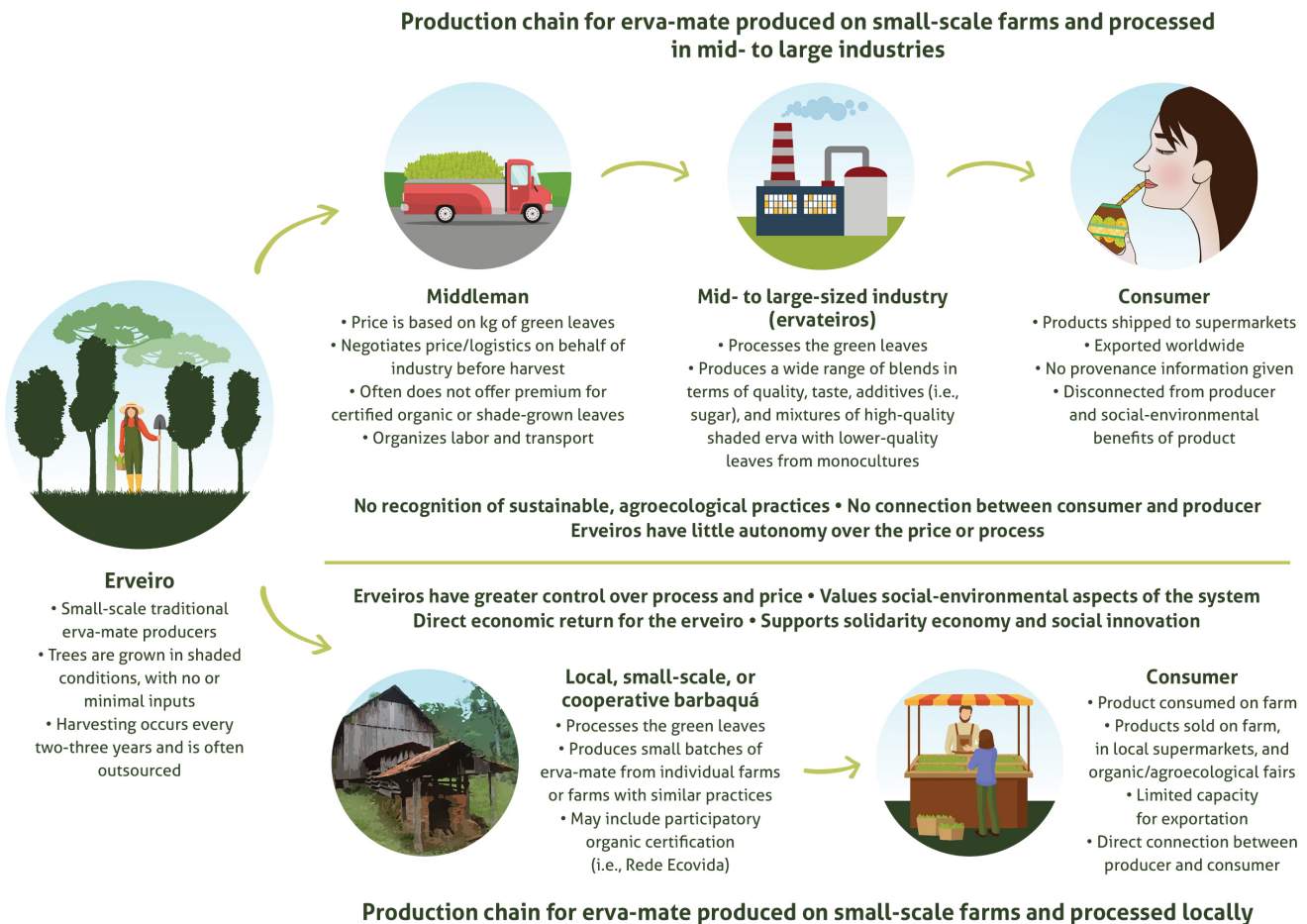
we sought to conduct an environmental oral history that shifts away from the traditional dynamic of interviewer-interviewee, enabling dialogues to be multidimensional, incorporating myriad perspectives. However, we were also attentive to the ways in which the memories of the interview participants could offer new questions that extended beyond the knowledge of the interviewers themselves.

Oral history interviews were conducted between 2017 and 2019 in seven different municipalities in Southern Paraná and Northern Santa Catarina States. The field research included 33 interviews with 39 interviewees, including men and women, youth and adults from the same social-environmental region that consists of a variety of locations transversally linked by common cultural and historical elements. Participants were identified through our partner institutions' long-term engagement with the communities and included a range of different stakeholders including individual *erveiros* and their families, members of local family farmers' unions, municipal and state employees, and *ervateiros* (Fig. 2). All interviews were recorded with a digital voice recorder and later transcribed for analysis and coding. Small-scale traditional erva-mate producers refer to themselves as *erveiros*, whereas those who run businesses and produce the finished product are referred to as *ervateiros*, with an implicit class and ideological distinction. Smallholder farmers who produce erva-mate using nontraditional practices, monoculture stands, and/or agrochemicals are seen by *erveiros* as not holding the same ethics and practices, and thus are not identified as such.

The semistructured interviews were guided by a series of open-ended questions and themes relating to participants' environmental memory and perceptions of the forest and erva-mate production, technologies and practices used in the system, how the system and forest have changed over time, and future challenges relating to climate change and food security (Appendix 1). In itself, this group of interviews constituted a range of relational perspectives experienced in a shared way. From the perspective of oral history, this body of narratives has significant representative vitality because we perceive oral narratives produced collectively (rural producers, researchers, technicians, and institutional actors) as shared memories, as discussed by Portelli (1997). From our methodological perspective, interviews produced through oral history are interpreted as narrative sources, which take on much greater significance than merely informational data. Understood as oral narratives, our attention focuses on understanding the subjective systemic nexuses that are articulated in the production of common values, senses, and meanings. As such, this set of interviews is full of possibilities for understanding perceptions related to the context, which goes beyond attaining a sample of predetermined quantity, which is almost always insufficient. Rather, the interviews offer individual narratives that are inscribed with perceptions of the world and the environment beyond the individual, with a wealth of evidence of dominant, residual, and emerging meanings that have not been considered through other perspectives, as pointed out by Laverdi (2011).

One of the focal points of the interviews was to document and discuss traditional ecological knowledge (TEK) in relation to native forests and the production of erva-mate. Berkes (2008:7) defined TEK as "a cumulative body of knowledge, practice, and

Fig. 2. Typical production chain for erva-mate produced on small-scale, traditional farms. The cycle at the top represents processing of erva-mate through an *ervateiro*, or mid- to large-sized industry, usually negotiated through a middleman. The chain at the bottom represents processing of erva-mate locally in small or communal *barbaquás* (the infrastructure used to dry and process erva-mate in traditional systems), offering more autonomy for *erveiros*. Small-scale traditional erva-mate producers refer to themselves as *erveiros*, whereas those who run businesses and produce the finished product are referred to as *ervateiros*, with an implicit class and ideological distinction. Smallholder farmers who produce erva-mate using nontraditional practices, monoculture stands, and/or agrochemicals are seen by *erveiros* as not holding the same ethics and practices, and thus are not identified as such.



belief, evolving by adaptive processes and handed down through generations by cultural transmission, about the relationship of living beings (including humans) with one another and with their environment... It is an attribute of societies with historical continuity in resource use on a particular land.” Although it is often used to refer specifically to Indigenous knowledge, TEK can include settler communities that have locally evolved, continual, and historical resource use practices, that have adapted over generations to new technological and socioeconomic realities (Stevenson 1996, Berkes et al. 2000). In terms of erva-mate production, *erveiros* have developed TEK relating to forest resource management over generations, building on their experiences, and adapting to technological and social change. Thus, they continue to implement forest management practices that combine sustainability of food resources and healthy forests

with various crops, trees, and animal husbandry (see for example, Hanisch et al. 2019).

Generally, interviews with *erveiros* were conducted on the farm to foster a comfortable environment for sharing their stories and narratives, while also offering the opportunity to conduct walks through the forest and the farm. Moving through the landscape together with the research team, the farmers and their families demonstrated not only their TEK, but these walks would often trigger memories or additional information about erva-mate production, particularly in terms of how their own property and practices have changed over time. These experiences also demonstrated their environmental subjectivities and how their own history, and we would argue identities, are written into the landscape (Santos-Granero 1998).

To code the interviews for analysis, the research team collaboratively identified a hierarchical tree of themes and subthemes related to the guiding questions used in the interviews and those that emerged during the discussions themselves. We are using the shared, open access platform Taguette (<http://www.taguette.org>) to collectively code the interviews for subsequent in-depth analysis. Because this is an ongoing project, coding is still in progress; nevertheless, a preliminary review has highlighted some interesting emergent themes that were not necessarily expected by the research team.

PRELIMINARY RESULTS

One of the most salient themes that has emerged from the oral history interviews is the clear tensions between government regulations, laws, institutions, and daily lived experience and practices on traditional erva-mate producing farms. This is a topic that was not captured in the interview guiding questions yet emerged in more than half of the interviews. It was expressed by both younger and older *erveiros*, particularly those that are actively participating in the local family farmers' unions. As Williams and Riley (2020:221) have highlighted, "oral histories can provide insight into how such environmental power relations are experienced and contested" while complicating or contradicting dominant environmental narratives. Current legal restrictions on forest use in Southern Brazil have created a situation in which farmers feel they cannot use the resources they have protected and fostered for generations, whereas government institutions, and often conservationists, assume that without these restrictive laws, forest resources on small-scale farms would be decimated. As Joos (2004:125) noted in terms of cultural landscape conservation in Southern Germany, "the conservationists are not confident that users, as long as it serves their self-interest, would refrain from pushing species to extinction. In this view, land users, and land-owners in particular, are considered to be ill suited - from their very character and lack of expertise - to deal responsibly with a precious natural heritage." Similarly, in the Brazilian context, smallholder farmers are perceived as not to be trusted to maintain forest ecosystems.

This tension comes out of an historical context in which the vast majority of the Atlantic Forest biome was deforested throughout the late 19th and early 20th centuries, with the implementation of the Forest Code in the 1960s (Presidência da República do Brasil 1965) and the Atlantic Forest Law (Presidência da República do Brasil 2006) as radical efforts to halt such environmental destruction. These laws place significant restrictions on the amount and type of management that can occur in forests on private property. Although these and other environmental laws have not altogether stopped deforestation, as is clear from recent devastation in the Amazon forest from 2019, in Southern Paraná and Northern Santa Catarina States there is a higher incidence of forest cover than other areas of these states and much of this is related to traditional land-use through agroforestry erva-mate production (Marques 2014, Lacerda et al. 2020). However, farmers feel that they are being disproportionately affected by the law; unlike the large-scale agribusinesses that are responsible for much of the deforestation that has occurred, they lack the legal and economic resources to fight the fines they may incur if they harvest their forest resources, despite the fact that these practices are based on deep knowledge of the environment and generations of shared knowledge and practice. *Erveiros* do not want to

deforest their land because this would remove the very ecosystem that supports their erva-mate production and contradict their real affective relationship with and ethical understanding of the forest, but rather they want to remove fallen or dying trees, maintain optimal forest canopy cover, or harvest specific individuals to use for other purposes on the farm, such as for roasting the erva-mate leaves or making fence posts. However, the current regulatory system requires landowners to obtain permission from local environmental protection agencies that continue to view small-scale producers as drivers of deforestation; requests are generally denied. Meanwhile, three different government bodies, i.e., federal and state environmental agencies: Brazilian Institute of the Environment (IBAMA), Environmental Institute of Paraná (IAP), Environmental Institute of Santa Catarina (IMA), and the state environmental police have jurisdiction to give fines, sometimes despite permissions received by the appropriate authorities.

Nevertheless, the *erveiros* we interviewed recognize that they have played an important role in conserving forests, often increasing forest cover over the last generation. They know that their forests and farms provide a range of ecosystem services and benefits for society as a whole, such as protecting water springs and maintaining riparian forests. Similar to Singh's (2013) discussion of forest people in India, these erva-mate producers are reappropriating the meaning of forest; it is neither the useless land cover that should be transformed into monoculture, nor the untouchable pristine environment that must be protected at all costs, rather the forest is both productive and "environmental." Through this, they construct their own identity in relation to this forest, as stewards and knowledge bearers. *Erveiros* are not the uneducated, poor, outdated rural folk society assumes them to be, but stewards of an environment who harbor a deep understanding of a forest, which provides the environmental services and products that are necessary for the country to thrive, let alone confront changing climates, food insecurity, and a range of other issues. As Tauro and Guevara argue (cited in Williams and Riley 2020:226) "oral history is particularly important in understanding the actions of groups often blamed as the agents of environmental destruction... Incorporating their historical environmental knowledge from the very outset, and valuing collective environmental knowledge, they argue, is key to democratising conservation."

Another major theme that permeated the interviews that we have conducted to date is a preoccupation on the part of *erveiros* on the lack of autonomy in selling their products for a fair price and the insecurity that these traditional systems will not continue into the future. One of the biggest problems with the current erva-mate production systems is that most large-scale production is funneled through a few medium and large corporations that control prices paid for erva-mate leaves (Fig. 2). This topic was discussed by almost all interviewees because it was a theme included in the guiding questions, but the depth of the problem and its effects on small-scale producers was prevalent in our discussions. Again, it is an historical process in which small-scale *barbaquas* (the infrastructure used to dry and process erva-mate in traditional systems) were progressively squeezed out of the market through policies of modernization and public health regulations that made many traditional *barbaquá* processors unviable (Chaimsohn and Souza 2013). In São Mateus do Sul,

Paraná, for example, one interviewee informed us that in the 1980s, the municipality had hundreds of barbaquas, many of which were located on smallholder farms or run as cooperative enterprises among smallholders. Today, the municipality has eight large erva-mate processing factories and several smaller factories, the majority of which do not differentiate prices significantly between traditionally grown, shaded erva-mate, and those grown in monoculture stands, with the consequent use of agrochemicals. Because the producers have little autonomy over the processing of erva-mate, they are dependent on an industry that does not value or differentiate between the products they produce. Consequently, consumers of erva-mate (mainly as chimarrão, but also as toasted tea) have no recognition of the history, culture, or agroecological practices behind traditional erva-mate systems. There is a real concern among erva-mate producers that this lack of recognition will mean the end of traditional systems because new developments in monoculture stands can produce significantly higher yields through cloning, fertilization, and pest control. Erveiros recognize that the end of this traditional system means not only the end of a cultural and environmental practice and consciousness, but likely the end of the forest they have taken care to protect.

This anxiety about the future of the system is compounded by the lack of interest or engagement many young people have in traditional farming practices. As is the case in many rural areas throughout Brazil, there has been a significant exodus of young people to cities in the hopes of attaining a better life (Abramovay 1998). As Jessica, a young woman of 26, noted in her interview, even her teachers at the rural high school she attended espoused the idea that “in order to be someone, I have to leave the farm” (Nimmo et al. 2018). Some that do decide to continue farming do so with a very different mindset, having undertaken agronomy courses at local universities that disproportionately focus on modern agricultural practices, including mechanization, the use of agrochemicals, and clearing land for monoculture commodities. Thus, although these young people may decide to stay on the farm, their education tells them that traditional practices are outdated and in need of modernization.

DISCUSSION

These two major themes, related to tensions between policy and practice and concern for the future, permeated the discussions and narratives we have been documenting and echo similar concerns in traditional and indigenous agroforestry communities around the world. One of the major challenges traditional communities face is policies that disregard TEK or emphasize conservation over local livelihoods and well-being. In Iran, Valipour et al. (2014) noted that traditional silvopastoralists have been erroneously identified as key drivers of forest degradation and loss, leading to policies that prohibited forest use by traditional users, thus creating significant conflict between local populations and government agencies. They also underscored, however, that innovative management approaches that integrate traditional knowledge and practices with ecosystem regeneration goals have not been considered. In the Brazilian Amazon, a recent study has examined the complex relationship between government agencies and local communities in an extractive reserve, particularly in terms of promoting biodiversity conservation, and highlights the need for local communities to have agency in their interaction with government authorities and

for government institutions to support decision making at the local level (Mooij et al. 2018). Examples of the importance of integrating local and traditional knowledge and forest management practices in local-scale efforts to restore forests, reduce poverty, and increase food security have been highlighted in several country-level studies by the International Union for the Conservation of Nature (IUCN) and the World Resources Institute (WRI), including Brazil and Guatemala (Kumar et al. 2015). Meanwhile, the IUCN’s strategies for forest landscape restoration underscore that integrated approaches in which all stakeholders are involved ensure that strategies to address forest loss and fragmentation, loss of ecosystem services, and threats to human well-being are culturally relevant and sensitive to local realities. Furthermore, recent high-level reports (i.e., HLPE 2017, FAO 2019) are calling attention to the need to incorporate traditional and local knowledge into productive systems to ensure that they are appropriate at the local scale, while also addressing the myriad economic, cultural, and social needs of production, and human and ecosystem health and well-being.

The information from the oral history interviews are being integrated into our transdisciplinary research, which includes a range of scientific and community perspectives and is beginning to inform several outcomes and strategies in our partner communities. One major development in terms of legitimizing and supporting the traditional knowledge and practices of our partners is the optimization and replication of these systems as models for forest resource management and productive forest restoration. As Persson et al. (2018) have noted, this “practical experience, and local knowledge more generally, should be integrated early on in the research process” and it should not be used to simply verify more scientific evidence, but rather to understand how people experience their environment. Researchers from one of the project’s key partners, Embrapa Forestry, are leading this aspect of the project and have begun to leverage information from the oral history interviews, field visits, and knowledge sharing workshops to test and replicate multispecies productive agroforestry systems based on traditional knowledge that can be extended to other land uses to restore degraded areas or to transition from monoculture systems (see for example, Lacerda 2019a, b, Lacerda et al. 2020). The legal regulations that severely limit the use of forested areas (Legal Reserves and Areas of Permanent Protection) on rural properties have made increasing forest cover across the landscape extremely difficult because landowners view forested lands as worthless and untouchable. Thus, innovative productive systems are needed that not only restore diverse and resilient ecosystems, but also generate income for the farmer. The successful implementation of such systems across 50 small-scale farms in the region (Lacerda et al. 2020) is providing information to update current environmental policies that threaten the continuation of traditional agroforestry practices.

Another significant development has been the creation of a civil society organization (CSO), CEDERva (Centre for Development and Education of Traditional Erva-mate Systems; cederva.com), which seeks to consolidate and disseminate the research and knowledge around these traditional systems. As in many other regions, small-scale farmers are often left out of decision-making processes and policy development related to production (FAO 2019). As such, CEDERva was developed to support continued

research and outreach activities that empower small-scale erva-mate farmers and facilitate collaborative and sustainable approaches to forest management. The prevalent tensions between government agencies and *erveiros* has compelled members of the CSO to begin discussing the current tensions between conservation, agricultural expansion, and traditional agroforestry systems across policy and institutional circles, leading to some interesting developments that show promise for the future. At the 5th Symposium on Traditional Erva-mate Production, held in December 2019, we organized a round-table discussion focused precisely on the management of forest ecosystems in the context of agroforestry and the inherent contradictions in current policy and practice. Although the conversation was only just beginning, one of our roles as research partners and advocates is to facilitate these discussions to ensure that the voices of the *erveiros* are heard and that their lived experience is recognized as a valid input.

In terms of improving farmer autonomy, the recent creation of the Strategic Council on Traditional and Agroecological Erva-mate Systems (Observatório dos Sistemas Tradicionais e Agroecológicos de Erva-mate), which includes representatives from state and federal agencies, CSOs, universities, and local chapters of the Family Farmers' Union, has been an important advancement. The aims of this council are many and include not only supporting the continuation of these systems, but also the creation of cooperative and solidarity efforts to gain greater control over the production chain. One of the key concerns for *erveiros* is the lack of recognition by industry of the differential quality of their product. Although some *erveiros* participate in organic certification systems, gaining certification is often prohibitively expensive with little return for the farmer because the industries that process the erva-mate pay only a slight premium for organic certified products. Meanwhile, programs such as Fair Trade also require industry involvement, which considering the historic distrust between *erveiros* and *ervateiros*, has been minimal and fraught with suspicion. Some farmers have turned to participatory certification systems, such as the organic and agroecological certification provided by Rede Ecovida (<http://ecovida.org.br/>), and several other social innovation initiatives, such as a cooperative agroindustry, participatory certification, and the development of several geographical indications are being explored and implemented to add value to the erva-mate produced in traditional systems. Further, our research team is developing and testing community-based sustainability indicators that will help to define participatory certification of these traditional systems and provide guidelines on implementation and improving sustainable production. These efforts aim to increase the control farmers have over price, supply chain, processing, marketing, and end products, which in turn brings greater economic stability and increased recognition of the social-ecological value of these systems (Fig. 2). As noted in the FAO's recent report on *The State of the World's Biodiversity* (FAO 2019:381), stakeholder groups like the Strategic Council and the CSO have an important role in campaigning and advocacy for and with small-scale farmers and "in promoting practical activities relevant to the sustainable use and conservation of biodiversity for food and agriculture." Thus, both the Strategic Council and CEDerva offer the social and political capital and expertise necessary to advance such strategies in a political climate that tends to ignore small-scale farmers and support the interests of large agrobusiness.

CONCLUSION

This project highlights the real value that traditional erva-mate production practices have in terms of culture and sustainability because they foster the continuation of intangible heritage, while also supporting the maintenance of natural forest ecosystems. The discussions and narratives produced provide a deep understanding of the cultural, social, and economic values associated with forests, all of which will be the subject of more in depth, future analysis. Documenting producers' histories and culture initiates a process of valuation of traditional systems that can be used by communities to differentiate themselves in the market, not only for greater economic return, but also for the recognition of their ecological and social-environmental values in Brazilian society. From this perspective, we are helping to foster a more attractive environment for young people, who can envision a future with possibilities for innovation and renewal, and thus maintain and develop these traditional production systems.

Responses to this article can be read online at:

<http://www.ecologyandsociety.org/issues/responses.php/11942>

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Data Availability:

The data that support the findings of this study are available on request from the corresponding author, ERN. The oral history interview transcripts will be made openly available on completion of the project at cederva.com and archived in the Center for Historical Research and Documentation at the State University of Ponta Grossa.

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Appendix 1: Guiding themes and questions discussed during oral history interviews

Araucaria Forest, environmental memory, and traditional knowledge

- How was/is the forest used?
- What species were/are collected and used, including medicinal plants, species other than erva-mate?
- How was the forest in the past?
- Are there tensions between maintaining the forest and farming, i.e., pressure to deforest for monoculture crops?
- Why did you decide to maintain forest on your property? Why was this important to you?

The production of erva-mate in traditional systems: memory of labor practices and technologies

- Why have you maintained a traditional system on your property?
- What technologies do you use? How has the system evolved during your lifetime?
- How have the practices changed (i.e., in terms of cultivation, collection, processing) from the system your grandparents used?
- What other species or products do you cultivate with erva-mate (i.e., cattle and other livestock, other forest species, crops)? Do you use an agroforestry system?
- Who buys your erva-mate and how does it figure in the production of the family farm?
- When and how do you harvest the erva-mate? What are the harvesting practices you use?
- Who participates in the harvesting? Do you contract a third-party to do the harvest?
- What is the end market of your product? Do you process the erva-mate yourself?
- Is there a difference between the traditional shaded system and others?
- What is your vision of the future of this system?

Food security, climate and cultural change

- Can erva-mate production help families to continue living and working on family farms?
- How does the family meet its subsistence needs? Do you have a garden (and who tends it)? Do you consume your own production? How much comes from off the farm (trade or purchase)?
- Do you have a spring or well on your property? Have you noticed changes to the amount or quality of the water? How does water availability relate to deforestation in the region? Has it affected your production?
- Have you noticed changes in the production of erva-mate, in terms of harvesting season, changes in production, pest infestations, drought, excessive rain, etc.?
- Are your children interested in the life of an *erveiro*? Do they help with harvesting?
- What are your expectations for the future of your farm?