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HOW CAN WE TEACH OUR CHILDREN IF WE CANNOT ACCESS THE FOREST? GENERATIONAL CHANGE IN MAPUCHE KNOWLEDGE OF WILD EDIBLE PLANTS IN ANDEAN TEMPERATE ECOSYSTEMS OF CHILE

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For many indigenous peoples, the contributions of wild edible plants go well beyond nourishment; they are often also used as dye and medicines, as well as markers of identity. However, historical and contemporary processes of land grabbing, forest loss, acculturation, and lifestyle changes may erode the transmission of plant knowledge to new generations. In this paper, we document 1) the botanical knowledge of wild edible plants and 2) perceived influences on the transmission of this knowledge to younger generations in a Mapuche community in Andean temperate forests, Chile. Thirty-seven people participated in this study. We conducted participant observation, freelists, and informal, photo-elicitation, and semi-structured interviews. A total of 47 wild edibles were recorded (42 plants were determined to species level by participants). Digüeñe *(*Cyttaria espinosae*; Smith's Index of Saliency, S = 0.82) was the most salient wild edible, followed by* changle *(*Ramaria flava*, S = 0.68),* maqui *(*Aristotelia chilensis*, S = 0.67),* murra *(*Rubus ulmifolius*, S = 0.59), and* piñón *(*Araucaria araucana*, S = 0.56). Participants provided detailed information on species seasonality, ecology, and changes in availability over time. Most adult women and elders had a comprehensive knowledge of wild edibles. However, younger generations were not learning what the elders had once learned. The lack of access to forests and the formal school regime were reported as the main factors interrupting the transmission of knowledge. Because Mapuche pedagogy is oral and in situ, land loss and the school regime have left younger generations with few opportunities to engage in these forms of indigenous pedagogy.*

Keywords: *indigenous pedagogy, land loss, traditional ecological knowledge, knowledge transmission*

Introduction

Wild edible plants have nourished humans for hundreds of thousands of years (Turner et al. 2011). Wild edibles can contribute to dietary diversity and maintenance of health (Afolayan and Jimoh 2009; Arnold et al. 2011; Grivetti and Ogle 2000; Nabhan 2014; Ogle et al. 2003; Pfoze and Kumar 2012). Further, they can be important socio-economically as dyes, shelter, fibers, and for sacred purposes (Abbasi et al. 2013). The use of wild edibles is a source of cultural identity, reflecting deep connections to the land and complex bodies of knowledge—more widely

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known as traditional ecological knowledge—about natural environments, survival, and sustainable living (Turner et al. 2011:200).

The use of wild edible plants is contextualized in space and time, and dependent on several factors, such as species availability, site accessibility, cultural acceptability, and traditional ecological knowledge (Berkes 2012; Kuhnlein and Receveur 1996; Myers et al. 2004; Turner et al. 2011). For many indigenous peoples, historical and contemporary socio-ecological processes, such as land grabbing, displacement, and forest loss, have limited the use of wild edible plants. Processes of acculturation, migration, and lifestyle changes have replaced wild foods with industrialized foods (Delang 2006; Kuhnlein and Receveur 1996; Uauy et al. 2001).

The transmission of ecological knowledge occurs through multiple channels and means. In many cultures, vertical transmission of knowledge within familial lineages is complemented by horizontal transmission occurring between individuals of the same generation (Eyssartier et al. 2008; Setalaphruk and Price 2007; Somnasang and Moreno-Black 2000). Not only is the collection of wild edible plants a learning event, but so too are their preparation and consumption (Cruz-García 2006). In order to successfully and safely use wild edible plants, it is necessary to know where specific plants grow, what the plants look like, what parts of the plants are needed, their seasonality, and techniques for harvesting, processing, and preparing them in sustainable ways. Cultural patterns of decreasing wild edible plant use, associated with historical and contemporary socio-ecological changes, may strongly interfere with the transmission of ethnobotanical knowledge to new generations (Ladio 2001).

In southern South American temperate ecosystems, Mapuche indigenous communities have gathered wild edible plants for centuries as a complement to their crop-livestock sustenance systems (Bengoa 2003; Coña and de Moesbach 2010; Montalba and Stephens 2014). The name Mapuche, meaning people (*che*) of the land or earth (*mapu*), reflects the interdependence of the Mapuche with the landscape they inhabit (Rozzi et al. 2008). The Mapuche have experienced socio-ecological processes of land grabbing, acculturation, and displacement for centuries (Bengoa 2003). The Mapuche resisted Spanish domination for approximately 300 years and resistance vis à vis the Chilean State is still ongoing in some areas. After independence in the early 1800s, the Chilean government began an intensive wave of land transformation, wherein the government promoted the transfer of indigenous territories to European people. Because of the conflicts that arose as the new settlers established in the Mapuche territory, the government undertook a military campaign in 1861 known as the "*Pacificación de La Araucanía*" to counter Mapuche resistance to land theft. As a result, Mapuche people were displaced from their lands to agriculturally less-productive areas, such as mountainous lands, and placed in Indigenous Reserves (Armesto et al. 2001; Montalba and Stephens 2014; Peredo and Barrera 2005).

Although several ethnobotanical studies have been conducted in various Mapuche communities (Coña and de Moesbach 2010; Contreras 2009; de Mösbach 1992; Egert and Godoy 2008; Gumucio 1999; Herrmann 2005; Meza and Villagrán 1991; Smith-Ramírez 1994, 1996), most took place in Argentina, particularly in the Patagonian steppe (Ladio 2004; Ladio and Lozada 2000, 2003, 2004a, 2004b; Molares and Ladio 2012; Rapoport and Ladio 1999). The present study broadens

our understanding of Mapuche ethnobotanical knowledge to include other ecosystem types and socio-cultural contexts.

In this paper, we document the state of knowledge of wild edible plants and the maintenance of knowledge transmission in a Mapuche community in Andean temperate forests, southern Chile. Specifically, we 1) document ethnobotanical knowledge of forest wild edible plants and 2) investigate perceived historical and contemporary socio-ecological factors influencing today's use of wild edible plants and how this knowledge is transmitted to younger generations.

Methods

Study Area and Research Participants

This study was conducted in Rayen Lelfun, an indigenous Mapuche community located in Menetue (39° S, 71° W), Pucón municipality, La Araucanía Region, southern Chile. The climate is temperate, with a mean annual precipitation of 2500 mm. Elevations range from 200 to > 2800 m of altitude in a mountainous topography. The vegetation is comprised of deciduous forests dominated by *Nothofagus* and *Lophozonia* (southern beech) species at lower altitudes and mixed deciduous with conifer *Araucaria araucana* (monkey-puzzle tree) forests at higher altitudes (Gajardo 1995).

Temperate forests cover approximately 29% of the region (908,501 ha) and are largely protected in State Protected Areas (304,990 ha, 9.58% of total regional area). Most agricultural land is comprised of *fundos* (farms of hundreds or thousands of hectares) owned by non-Mapuche people, while the majority of the Mapuche rural population lives on small-hold properties (Söhn 2012). The Mapuche indigenous population (~6500 people) comprises 29.2% of the total of the municipality (22,168 total inhabitants) (INE 2005).

In Rayen Lelfun, families own small farms (< 5 ha). Each house is surrounded by home gardens, a *quinta* (orchard), and *chacras* (potato fields) and are bordered by well-defined grasslands for cattle and crop fields. People practice agriculture and animal husbandry. Because farms are small, these practices are more for subsistence than for commercial purposes. There are 20 families in Rayen Lelfun. The population in the community is aging, with few children and youths. The *Lonko* is the chief in the community and represents the community in traditional and religious ceremonies. The local language, called *Mapuzungun* (*mapu* = earth and *zungun* = speech), has gradually been lost in the area. *Mapuzungun* is spoken only by some elders; most of the inhabitants speak Spanish as their first language and know only basic words in *Mapuzungun*.

Lines of Inquiry

Most of the field research was conducted with the contributions of eight women as key participants (women are responsible for most of the activities related to food procurement). However, men and children participants were also involved in the study. We recruited participants through successive-referral sampling. After obtaining free, prior, and informed consent from all members of the community,

A. Barreau, accompanied by J. T. Ibarra, started visiting women in their houses and participating in daily working activities and community events. In total, 37 different people participated in the research (eight were members of neighboring communities). Participants from Rayen Lelfun belonged to 12 families. Our sample of participants was selected opportunistically so as to work with those most interested in our subject matter. As such, it was not a strictly representative sample. However, studies of this kind are highly credible (high external validity) when supported with ethnographic data (Bernard 2011) and our findings were guided by ethnographic understandings throughout.

Comprehending the myriad of dimensions of human-plant relations in any particular context requires the mobilization of diverse methods (Wyndham 2009:272). Five main lines of inquiry were undertaken, as follows:

1. Participant Observation and Informal Interviews.
   These were used over a period of six months (November 2012–April 2013) to experience the daily activities of families. We participated in the community's everyday events and agricultural activities. On occasion, we attended religious ceremonies, community meetings, and heritage fairs. We also joined walking field trips for gathering plants or firewood, visiting relatives, or looking for livestock (*campear*). These were rich experiences with respect to data collection, species identification, and as a deeper way of unveiling perceptions about human-plant relations (Johnson and Davidson-Hunt 2011).
2. Freelists.
   We engaged 13 women in freelisting interviews. We asked the women to "list all of the wild edible plants you can think of. By wild, we mean plants that do not need to be sown or planted." Smith's index of saliency (Smith's S) was calculated to measure the perceived relative importance of plants mentioned (Smith 1993) in the resulting freelists. The formula for Smith's Index is:

$$S = \left(\left(\Sigma\left(L - R_j + 1\right)\right)/L\right)/n$$

   where "S is the average rank of an item across all lists in the sample, weighted by the lengths of the lists in which the item actually occurs; L = the length of (number of items in) a list; Rj = the rank of item j in the list (first = 1); and n = the number of lists in the sample" (Smith 1993). We identified plants named in these lists by their scientific names and classified according to origin (native and exotic), parts used as food (shoots, stems, petioles, roots, tubers, rhizomes, seeds, fruits or arils, leaves, fruiting body in the case of fungi, and decayed wood; adapted from Rapoport and Ladio [1999]), and life-form (trees, shrubs, herbs/grasses, vines, ferns, and fungi). We used a scree plot to select the species to study in greater depth through photo-elicitation interviews (Bernard 2011).
3. Photo-Elicitation Interviewing.
   We selected 21 species based on the freelist results, using only those that were mentioned by 35% or more of the respondents. We then asked eight participants to comment on photographs of each of these plant species in an interview in which we asked about common names (in Spanish and/

or Mapuzungun), gathering seasons and techniques, preparations, abundance, and variations in availability based on changes in the landscape (Bignante 2010; Harper 2002). We also encouraged open-ended responses so as to collect personal stories related to each species. A proficiency index was created from interviews, in which the following three questions were posed for each of the 21 species: (1) identification, (2) knowledge of the gathering season, and (3) knowledge of their preparation. A value of one was assigned to a correct answer (determined by expert participants) and zero was assigned to a wrong or no-answer. The sum of these values was considered as an index of proficiency for each of the eight respondents, 63 being the maximum score possible if all answers were correct.

4. Semi-Structured Interviews.
These complemented the informal interviews to investigate perceived factors influencing the use of wild edible plants and how knowledge is transmitted to younger generations. These interviews were piloted with a subsample of three women to minimize ambiguous questions or inappropriate vocabulary (Bernard 2011). We then conducted this semi-structured interview with 11 women.
5. Qualitative Data Analysis.
We analyzed our field notes and interviews to identify emergent themes, identifying implicit and explicit ideas, which we organized and coded for salient patterns. We used Braun and Clarke's (2006) phases of analysis to identify patterns of meaning to answer the research questions: (1) familiarization with data by transcribing verbal data, reading, and re-reading the complete data set and jotting down initial insights; (2) coding and collating data to organize all the data into meaningful groups; (3) searching for themes among codes and examining how codes combine to form over-reaching themes; and (4) reviewing, defining, and naming themes.

Ethical Process Statement

This research was approved by the Behavioral Research Ethics Board (BREB) of the University of British Columbia on September 12, 2012. Approval was also obtained from local authorities in the community on October 22, 2012. Free, prior, and informed consent was followed as a principle throughout the research. Regarding confidentiality, only the name of the community, not those of individuals, can be disclosed, as agreed upon with the participants. Results were returned to the community in February 2015 both verbally and in a written form to the local authorities.

Results and Discussion

Wild Edible Plant Knowledge

In response to the freelist exercises, our respondents listed a total of 47 wild edible plants belonging to 45 genera and 34 families (Table 1). Rosaceae was the most represented family with five species, while Asteraceae and Cyttariaceae were represented by three species each. About 60% of families were represented by single

species, showing a relatively high taxonomic diversity. By in situ observation or identification through photographic images, 42 plants were determined to the species level, four were identified to the genus level, and one item was impossible to identify. According to the Smith's Index of Saliency (S), *digüeñe* (*Cyttaria espinosae*, S = 0.82) was the most salient wild edible, followed by *changle* (*Ramaria flava*, S = 0.68), *maqui* (*Aristotelia chilensis*, S = 0.67), *murra* (*Rubus ulmifolius*, S = 0.59), and *piñón* (*Araucaria araucana*, S = 0.56) (Figures 1 and 2).

The collective memory of the community has incorporated numerous exotic plants into its repertoire. Of the wild edibles mentioned, 28% were exotic species and five of these were culturally very salient (frequency of mention > 35%) (Figure 2). Hernández (2008) explores how, globally, exotic plant species progressively become incorporated into traditional knowledge, while knowledge of native species is lost. The most salient introduced species were *murra* or elmleaf blackberry (*Rubus ulmifolius*, S = 0.52), *mosqueta* or rosehip (*Rosa rubiginosa*, S = 0.41), and *castaña* or chestnut (*Castanea sativa*, S = 0.49). For most exotic species, Mapuche names were unknown or nonexistent. Many of these were considered "weeds" often associated with human habitation (Turner et al. 2011). Elmleaf blackberry and rosehip provide people with ample fruits during summer and income from selling jams; however, controlling the invasion of these species to keep their lands "clean" for agriculture is an ongoing and exhausting task. A much relished "weed" was *yuyo* (*Brassica rapa*), which are leafy greens that grow naturally in home gardens and between wheat plantations.

Trees were the most-cited life-form (12 species), followed by herbs and grasses (11 species), mushrooms (10 species), and shrubs (nine species). Fruits were the most commonly reported edible part with about 43% of species (20 species), followed by fruiting bodies of mushrooms (10 species) and leaves (seven species) (Figure 3). The most salient fruits gathered during the field work period included the *maqui* berry (*Aristotelia chilensis*), which was consumed raw and also prepared as a drink called *teku*; the elmleaf blackberry, introduced by the Spanish in the early 1500s, which was gathered for preparing jam and also for dying wool; the Chilean guava or *murta* (*Ugni molinae*), a small and perfumed berry, which was mixed with quince and preserved in cans for the winter and also prepared as *chicha* (a fermented alcoholic beverage); the fruit of the *copihue* or *kolkopiw,* the Chilean bellflower (*Lapageria rosea*), which was cherished mostly by children for their sweet taste; and the rosehip, which was gathered for making jam.

The fruiting bodies of mushrooms, the second most commonly reported edible part, were highly appreciated, particularly during fall and winter, as substitutes for beef, lamb, and pork that need to be purchased in markets during those seasons. Spring mushrooms, such as *digüeñe* (*Cyttaria espinosae*) and *chicharrón de cerro o de monte* (*Gyromitra antarctica*), also come out during a time of low food availability when winter supplies have been exhausted. Edible fungi have contributed over generations to rural family's subsistence in southern Chile, as well as to household economies when traded (Catalán et al. 2005; Smith-Ramírez 1994, 1996).

The *ngüilliu or piñon*, the seed of the *pehuen* or monkey puzzle tree (*Araucaria araucana*), was the most salient seed. In past times, it was considered a staple food as it was gathered in large quantities in the fall to last until late spring (Coña and de Moesbach 2010; Ladio 2001). Gathering trips were very important for social

Table 1. List of wild edible plants mentioned on freelists, ordered by Smith´s Salience Index.

	Scientific name (FAMILY)	Mapuche name	Spanish name	Salience index	Frequency (%)	Origin[1]	Life form[2]	Use form[3]
1	*Cyttaria espinosae* (Cyttariaceae)	Diweñ	Digüeñe	0.817	100	N	M	FB [R, C]
2	*Ramaria flava* (Ramariaceae)	Changdi	Changle	0.681	100	N	M	FB [C]
3	*Aristotelia chilensis* (Elaeocarpaceae)	Maki, këlon	Maqui	0.671	100	N	T	F [R, C]
4	*Rubus ulmifolius* (Rosaceae)	-	Murra	0.592	100	E	S	F [R, C]
5	*Araucaria araucana* (Araucariaceae)	Ngüilliu [Pehuen]	Piñon	0.555	100	N	T	S [R, C]
6	*Gunnera tinctoria* (Gunneraceae)	Nalca [Pangue]	Nalca	0.53	92.3	N	H	Sh [R]
7	*Ugni molinae* (Myrtaceae)	Ünü	Murta	0.462	84.6	N	S	F [R, C]
8	*Chusquea culeou* (Poaceae)	Coyocho colew	Coligüe	0.45	92.3	N	S	Sh [C]
9	*Lapageria rosea* (Philesiaceae)	Kopiu [Kolkopiw]	Copihue	0.441	69.2	N	V	F [R]
10	*Rosa rubiginosa* (Rosaceae)	-	Mosqueta	0.409	84.6	E	S	F [C]
11	*Castanea sativa* (Fagaceae)	-	Castaña	0.408	69.2	E	T	S [C]
12	*Grifola gargal* (Meripilaceae)	Kalgal	Gargal	0.351	69.2	N	M	FB [C]
13	*Armillaria mellea* (Thricolomataceae)	Pëke	Pike	0.328	61.5	N	M	FB [C]
14	*Berberis* spp.* (Berberidaceae)	Mëchai	Michay	0.309	76.9	N	S	F [R]
15	*Gevuina avellana* (Proteaceae)	Ngëfü	Avellana	0.299	61.5	N	T	S [C]
16	*Brassica rapa* (Brassicaceae)	Ngedon	Yuyo	0.258	46.2	E	H	L [C]
17	*Ribes valdivianum*** (Grossulariaceae)	Mulul	Parrilla	0.23	46.2	N	S	F [R]
18	*Agaricus* sp. (Agaricaceae)	Kallampa	Callampa	0.21	38.5	E	M	FB [C]
19	*Cyttaria berteroi* (Cyttariaceae)	Pinatra	Pinatra	0.185	38.5	N	M	FB [R]
20	*Fragaria chiloensis* (Rosaceae)	Kelleñ	Frutilla silvestre	0.181	46.2	N	H	F [R]
21	*Fuchsia magellanica* (Onagraceae)	Chillko	Chilco	0.17	38.5	N	S	F [R]
22	*Oxalis* spp. *** (Oxalidaceae)	Kulle	Cuye	0.135	23.1	-	H	L [R]
23	*Luma apiculata* (Myrtaceae)	Kollimamül	Arrayan	0.125	23.1	N	T	F [R, C]
24	*Sambucus nigra* (Adoxaceae)	-	Sauco	0.123	23.1	E	T	F [R, C]
25	*Lardizabala biternata* (Lardizabalaceae)	Kowël	Coulle, Coguil	0.119	23.1	N	V	F [R, C]
26	*Peumus boldus* (Monimiaceae)	Foló	Boldo	0.084	23.1	N	T	F [R]
27	*Prumnopitys andina* (Podocarpaceae)	Lleuqui	Lleuque	0.074	30.8	N	T	F [+][R, C]
28	*Mentha* sp. (Lamiaceae)	-	Menta	0.067	7.7	N	H	L [R]
29	*Malus* sp. (Rosaceae)	Manshana	Manzana silvestre	0.067	7.7	E	T	F [R]
30	*Nasturtium officinale* (Brassicaceae)	-	Berro	0.059	30.8	E	H	L [R]
31	*Cryptocarya alba* (Lauraceae)	Pengu	Peumo	0.057	7.7	N	T	F [R]
32	*Muehlenbeckia hastulata* (Polygonaceae)	Küllo	Quilo	0.047	15.4	N	V	F [R]
33	*Prunus* sp. (Rosaceae)	-	Ciruela silvestre	0.046	7.7	E	T	F [R, C]
34	*Taraxacum officinale* (Asteraceae)	-	Diente de león	0.031	7.7	E	H	L [R]

Table 1. Continued.

	Scientific name (FAMILY)	Mapuche name	Spanish name	Salience index	Frequency (%)	Origin[1]	Life form[2]	Use form[3]
35	*Nothofagus dombeyii* **** (Fagaceae)	Huempe, Michahuarro	Huempe	0.028	7.7	N	T	DW [R]
37	Unknown	-	Grosella del hualle	0.026	7.7	-	M	FB [R]
36	*Greigia sphacelata* (Bromeliaceae)	Nüyu	Chupón	0.026	15.4	N	S	F [R]
38	*Cyttaria harioti* (Cyttariaceae)	Llau llau	Digüeñe del coigüe	0.02	7.7	N	M	FB [R, C]
39	*Gyromitra antarctica* (Helvellaceae)	-	Chicharrón de cerro, poto	0.02	7.7	N	M	FB [C]
40	*Mimulus glabratus* (Scrophulariaceae)	Quechuinhuaca	Lechuga de agua	0.017	7.7	N	H	L [R, C]
41	*Lophosoria quadripinnata* (Dicksoniaceae)	Añpe	Ampe	0.015	7.7	N	F	Sh [C]
42	*Hypochaeris radicata* (Asteraceae)	-	Flor del chancho	0.014	7.7	E	H	L [R]
43	*Luzuriaga radicans* (Philesiaceae)	Paupauhuen	Coral, Quilineja	0.01	7.7	N	V	F [R]
44	*Solanum* sp. (Solanaceae)	Poñü	Papa silvestre	0.007	7.7	N	S	Tu [C]
45	*Onopordon acanthium* (Asteraceae)	-	Cardo blanco	0.006	7.7	E	H	Sh [R, C]
46	*Fistulina hepatica* (Fistulinaceae)	-	Lengua de vaca	0.005	7.7	N	M	FB [C]
47	*Chenopodium quinoa* (Amaranthaceae)	Quinwa	Quinoa	0.003	7.7	N	H	S [C]

* = All species have edible fruits. Two species were identified: *Berberis darwinii* and *Berberis microphylla.*

** = All species have edible fruits. *Ribes valdivianum* was the most common in the area.

*** = All species are edibles.

**** = Rotten wood of other species was also eaten in the past, with *Nothofagus dombeyii* being the most common.

[1] N = native, E = exotic;
[2] F = ferns, H = herbs and grasses, M = mushrooms, S = shrubs, T = trees;
[3] Edible part [consumption form]: Dw = decayed wood with fungi mycelium, F = fruits, F $^{+}$ = arils, FB = fruiting body, L = leaves, S = seeds, Sh = shoots and stems or petioles, Tu = tubers. [R] = eaten raw, [C] = eaten cooked, [R, C] = both raw and cooked.

Figure 1. Most salient wild edible plants according to Smith´s Salience Index. From left to right and top to bottom: *digüeñe, changle, maqui,* and *piñones.*

cohesion and knowledge transmission (Herrmann 2006). Although people in the community do not strictly depend on the *piñon* anymore, families always make the effort to have *piñones*. Whenever someone in the extended family comes back from *piñoneando* (the act of gathering *piñones*), it is customary to share the harvest with kin. This is especially true with elders, as they are most eager to eat wild foods. As one elder expressed, while he peeled and savored some boiled *piñones* that his son had brought him from the mountains, "When I taste them, I feel that I am back in the mountains."

The naming portion of the freelist exercises, and the subsequent classification of some species as belonging to the "wild edibles" domain, speaks to the relative nature of the term "wild." Following Turner et al. (2011), some species considered "*de monte*" ("wild") by local people could be classified as domesticated (e.g., *quinwa, Chenopodium quinoa*, or chestnuts, *Castanea sativa)*, semi-domesticated (e.g., *yuyo, Brassica rapa*), or paradomesticated (i.e., caring for and promoting in situ, e.g., *copihue, Lapageria rosea*). It has been suggested that there are no easy distinctions between "wild" and "cultivated" foods for many agricultural societies, as this classification can be unclear (Cruz-García and Price 2011; Harlan 1992; Lévi-Strauss 1950). People may envision plant foods as existing along a continuum, ranging from the entirely wild to most domesticated (Bharucha and Pretty 2010; Lévi-Strauss 1950; Mazhar et al. 2007; Wyndham 2009). For some participants, an

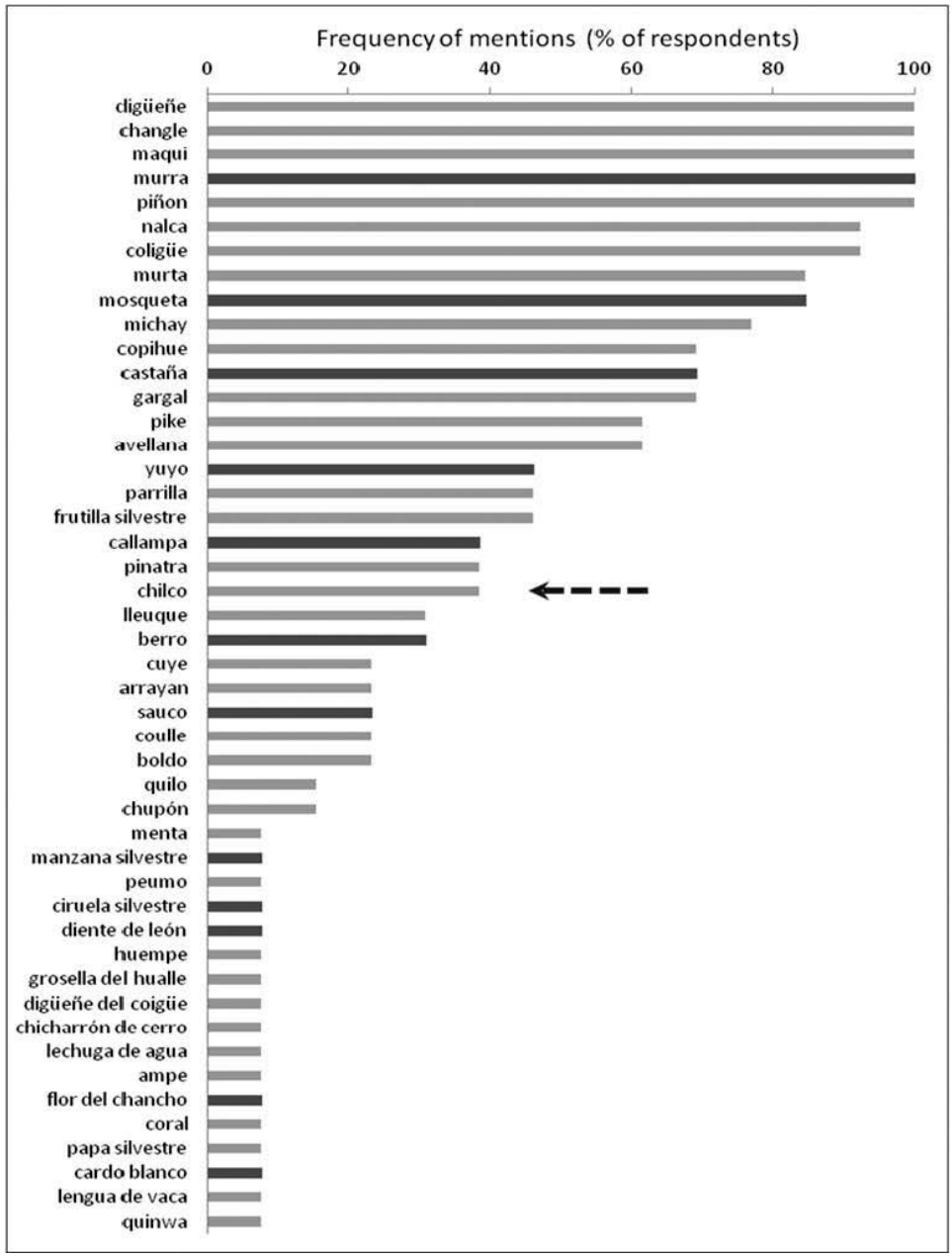

Figure 2. Frequency of items mentioned in freelist exercises. Black bars show the exotic species. Arrow indicates the elbow chosen to further explore most salient species of the cultural domain.

apple variety (*Malus* sp.), plums (*Prunus* sp.), and chestnuts (*Castanea sativa*) were classified as wild foods. The chestnut tree was believed to grow naturally, even though it was considered by local people to be a recent introduction to the landscape. The apple tree, and probably the plum tree, were introduced by the Spanish

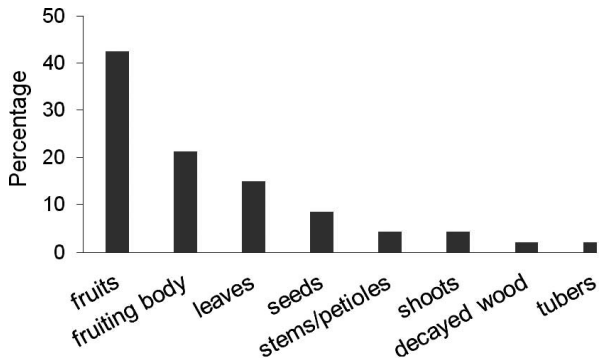

Figure 3. Edible parts of wild edible plants listed in freelists.

conquistadores (Coña and de Moesbach 2010; Montalba and Stephens 2014). Rosales, a Spanish chronicler, described apple forests from which the Mapuche made *chicha* (de Rosales 1989). As apple trees spread, they displaced many wild fruits from which *chicha* was made, including *mulul* (*Ribes valdivianum*), *quilo* (*Muehlenbeckia hastulata*), *ünü* (*Ugni molinae*), among others (de Mösbach 1992; Gumucio 1999). The Mapuche name for the apple fruit is *manshana,* a modification of the Spanish *manzana,* evidencing its assimilation from the European settlers (Villagrán 1998).

Some people reported eating *huempe* or *michahuarro*, rotten or decayed wood, mainly of *coigüe* (*Nothofagus dombeyi*), in the past. *Huempe* is a mixture of woody tissues and mycelia of cellulosic fungi (Smith-Ramírez 1994). It was eaten as bread with honey or *harina tostada* (toasted wheat flour). The juice released by the *huempe*, when pressed, was drunk as *chicha*. Another elder remembered that it was also eaten tossed into hot milk. Nowadays, it is just a memory since no one in the community eats *huempe* anymore.

According to the results of the photo-elicitation interviews about the 21 most salient plant species, our sample of eight adult women had a comprehensive knowledge of wild edibles. Participants were able to easily identify most species and generally provide detailed information on species ecological characteristics, such as habitat, water, and light requirements, abundance, and changes in availability. Participants knew forms of preparations, consumption habits (cultural meanings around preparation, eating and sharing food), and alternative uses. This ethnobotanical knowledge was not given as isolated information, but rather was elaborated within stories and memories of their individual plant-landscape relations through life. This unveiled the "ecological" aspect of traditional ecological knowledge, in which awareness of relationships is often more salient than discrete categorical knowledge (Wyndham 2009). Sometimes, exact seasonality or specific months for a wild edible plant did not come to the interviewees' minds immediately, but, as concurrent socio-ecological processes were remembered (e.g., an agricultural phase or ceremony), they were able to locate the plant knowledge in a culturally integrated way. Similarly, Gumucio (1999) found that Mapuche time-reckoning was explained by seasonal changes in vegetation along an annual cycle of natural, social, and ritual events. Perceptions of time differ across cultures (Janca

and Bullen 2003; Killsback 2013). Therefore, asking about calendar months to identify species' seasonality relies on a western notion of time that, in this case, was not consistent with Mapuche perspectives.

The interviewees' proficiency scores ranged from 48 to 59 out of a total possible of 63 (76% to 94%; mean = 53). Variance among the eight women interviewed corresponded more with participants' personal history of interest in edible plants and exposure to knowledgeable family members, rather than to factors such as age or years outside of the community. These eight women correspond to the older women in the community and, given their life experiences and important role in the acquisition and preparation of food, they represent the most knowledgeable community members in this regard compared to younger generations.

Transmission of Plant Knowledge: Sites of Construction and Social Institutions

Cultural transmission of traditional ecological knowledge in Mapuche pedagogy is oral and in situ, which is to say through lived experience: "We do not learn by reading, we are taught by doing" (Mapuche female Elder).

As in other cultures, knowledge transmission occurs through various means and channels, particularly from parents, grandparents, and peers (Setalaphruk and Price 2007; Somnasang and Moreno-Black 2000). Accompanying parents, grandparents, and older siblings to gather firewood, useful plants, or looking for lost animals in the woods were seen by interviewees as times of honing environmental skills. Not only is the collection of wild edibles considered a learning event, but so too are their preparation and consumption (Cruz-García 2006). This vertical transmission of knowledge was complemented by horizontal transmission occurring among peers. Gathering for consumption on the way to school, for example, was an important instance of learning from peers, also reported for children in India (Cruz-García 2006). Many adults remembered that, as children, they looked for wild foods to eat as snacks during school recess. Morning and evening walks to and from school with cousins, friends, and siblings were described by adult informants as instances of peer-to-peer learning, but also of self-learning as the natural environment was explored. This time and space for exploration nourishes and reproduces traditional ecological knowledge as a dynamic and cumulative body of knowledge across generations (Berkes 2012; Turner et al. 2011).

Walks in the surroundings and outings to gather wild edibles turned into ideal opportunities for us to assess the state of plant knowledge among children. Their limited knowledge regarding forest wild edibles and other useful plants became evident when compared to adults and elders. At times, just trying to name a relatively common species seemed challenging and, for most species, children did not know when and where to gather them or forms of preparation. This highlights how detached children's plant knowledge is from actual practice, as the skills involved in hands-on knowledge requires a higher degree of involvement in order to learn (Setalaphruk and Price 2007). For some teenagers, outings to gather *piñones* were the first time that they had seen a *pehuen* (*Araucaria araucana*). This contrasts with Wyndham's (2010) study on plant knowledge among Rarámuri children, in which overall use-knowledge scores were almost twice as high as naming scores.

The limited transmission of ethnobotanical knowledge, according to all adult participants, was related primarily to limited access to forests and, therefore, a lack of daily interaction with plant species. Because tasks, such as gathering wild edibles, are site specific, they are taught in the locations where they are practiced (Ruddle 1993). When asked about her thoughts on knowledge loss, a Mapuche woman expressed, "How can we teach our children if we cannot access the forest?" This mirrors how important forests are for intergenerational environmental learning since they have been, for centuries, a learning place for children to gain ecological knowledge (Ibarra et al. 2011).

The school regime was also mentioned as a cause of children's lack of interest in wild edibles. Since most children going into the seventh grade need to attend a boarding school in the nearest city, they often experience a gradual change in their food habits. Past generations attended the local school until sixth grade at most. Today, with children leaving the communities at a very young age, they become increasingly disconnected from traditional practices and land. Though families integrate their children into daily farm activities during weekends and holidays, many parents try to please their children by preparing meals that they request. This often means buying food that they would not normally purchase or consume. As a result, entire families gradually adopt more urban food habits and ecological knowledge of wild edibles and traditional food praxis is eroded (Pilgrim et al. 2008). We identified a manifest change in the tastes of younger generations towards urban foods as status symbols (Cruz-García 2006) and a concomitant disconnection with the landscape where they grew up, as they spend more time in urban settings (Krohn and Segrest 2010). Knowledge erosion of wild edible plants can be partially explained by how formal education ignores local resources, knowledge, and culture (Cruz-García 2006).

Factors Influencing the Use of Wild Edible Plants and Knowledge Transmission

Although a comprehensive ethnobotanical body of knowledge of wild edibles was recorded among adult women, this knowledge is being eroded. Today, only a few wild edible plants are gathered and consumed, in contrast to the number of wild edibles known by older people. This situation was also reported in Mapuche families of the Patagonian steppes of Argentina (Ladio 2001). To better understand what interferes with the use of wild edible plants and obstructs the transmission of knowledge about them, we asked about factors that limit access to and consumption of wild foods. Findings from these interviews, with eleven key women interviewees, are discussed below, along with information we gleaned from participant observation and informal conversations.

Accessibility: Traditional Gathering Sites in the Forest

When looking at the landscape in the study area, one appreciates the large native forests surrounding the community. Most of these forests are in the hands of *winkas* (non-Mapuche) or outsiders. "Now you need to ask for permission because they [outsiders] bought them, but I don't know what they plan to do… they just bought to grab hold of those virgin mountains. Because God left them for

everyone…he left them public, but now money gets them [the mountains]" (Mapuche female Elder). This commentary refers to the tradition that high mountain forests were owned by their *Ngen* (owner and caretaker of a natural entity), who allowed local people free access to forest products, such as the seeds of the monkey puzzle tree. In Mapuche belief system, families "owned" the piñones of some "pinaladas" that had been the family´s gathering spot for many generations, but the forest, overall, did not belong to them. Now things have changed.

In previous times, lands used to be open-access, even though every piece of agricultural land had its owner. Today, even though families have fenced their farms, it is socially acceptable to use a neighbor's lands as a public path. If someone needs a useful plant for medicine or to dye wool, and he or she knows someone in the area who has some on their farm, it is customary to just show up or call by telephone to seek permission to obtain the plant. Additionally, the current restricted access to forests has created a sort of fear of the unknown. For many women, forests were perceived as a dangerous place and most of them expressed fear of entering or exploring the forests alone. Berkes et al. (2000) describe how the use and management of wild resources by indigenous people can enhance both the quality and the abundance of the resources of interest. In this case, the abundance of some wild edibles is perceived to have been affected by the fact that traditional harvesters have limited access to them. In particular, it is thought that the *piñon*es are now producing less as a way to empathize with the Mapuche people and to restrict benefits for those who have purchased and closed the harvest grounds. "…People would collect enough *piñones* and other natural foods for their seasonal storage needs. Not anymore… now the land is all private, foreign people bought the higher areas already and closed them. Then that's why the monkey puzzle trees are giving fewer *piñones,* so that we do not despair..." (Mapuche female Elder). This speaks to the human-wild edible plant relationship as a symbiosis between people and the landscape, in which the land is animated, sentient, and cares for local people.

The buying power of outsiders, which out-competes that of Mapuche families, was perceived to be the reason why so much land is being acquired by non-Mapuche. Purchases occur in bits and pieces as small plots, one after the other. "They own a lot of land and they have kept buying. They buy very cheap because they surround you and then you have no choice but to sell" (Mapuche female Elder). This process is, in part, happening because young adults do not see a future in their small family farms and many migrate to urban centers (Schnettler et al. 2013). Their willingness to sell their inherited piece of land is influenced by their realization that the land is not enough to subsist on, coupled with the desire for an urban life. This strong migration to urban centers throughout the twentieth century has become the main demographic dynamic that characterizes the Mapuche people today (Altieri and Rojas 1999; Castillo 2008; Egert and Godoy 2008; Saavedra 2002).

Availability of Wild Edible Plants

After lack of access, scarcity was the second most frequently mentioned reason for not gathering many wild edibles. This was attributed to the decrease of forested areas on people´s farms. Today, forests are almost gone on most land owned by

local people. As space has become the limiting factor for subsistence, open fields have been allocated to agriculture or livestock farming. Fragments of forests still remain on steep land not suitable for agriculture or surrounding streams for the conservation of the water supply. As a consequence, species like *maqui* (*Aristotelia chilensis*), *avellana* (*Gevuina avellana*), *arrayán* (*Luma apiculata*), *mulul* (*Ribes* sp.), and *boldo* (*Peumus boldus*) are less abundant, as are vines that depend on larger trees, like *copihue* (*Lapageria rosea*) and *coulle* (*Lardizabala biternata*).

The use of plastic bags for gathering in place of the traditional vegetable fiber baskets made out of different vines was also mentioned as a possible cause of the disappearance of fungi. In the past, the acts of gathering with a basket helped to disperse fungi spores. Today, baskets are hard to find because basket-makers in the area have almost disappeared. Several participants also said that it was more convenient to walk with a plastic bag than to carry a rigid container like a basket.

Deforestation has also affected water resources and some of the species that depend on humid environments (Little et al. 2009), such as the *nalca* (*Gunnera tinctoria*). Because *nalcas* are sold in the market, there was a shared notion that people from town had overharvested the *nalcaderos* since they did not have consciousness ("ecological awareness") and knowledge of appropriate harvesting techniques, both of which have decreased the *nalca's* abundance. For example, participants mentioned the use of the machete to cut the leaves instead of the hands, taking all the leaves of one plant and destroying the roots of the *nalca*.

The presence of exotic tree plantations, mainly *Pseudotsuga menziesii* and *Pinus radiata*, which replace native forests, was also mentioned as contributing to the scarceness of some forest foods. "That was pure native forest; they cleared everything and planted pine...in pine plantations nothing grows, not even the wild blackberry that is so stubborn. Everything is dry and birds do not come, because birds seek what is native" (Mapuche female Elder). Most plantations belong to non-Mapuche farmers, but many small plantations were established in indigenous farms to replace native forests, encouraged by governmental projects that subsidized the replacement of native stands by fast-growing exotic plantations.

Some wild edibles, like *yuyo, quilo, maqui*, and many medicinal herbs that often grow in open areas and along roadsides were described as being scarce as a consequence of the herbicides used by the *fundo* owners. This use has transformed hedgerows from a source of food and medicines into simple barbed wire fences, impacting people´s health. "There were fewer diseases and every time they felt aches they drank their herbal infusions. And now, I realized as I walked that the farm owner pours liquid [herbicides] on everything along roadsides. That is where we picked our remedies" (Mapuche female Elder).

A lesser abundance of some wild edibles was also linked with actions of or punishments from supernatural entities. Wild edibles were considered to be food created by the superior entity (*Chaw Dios* or God) to use at no cost. "Chau Dios leaves so much food for his children...so we should not waste it" (Mapuche male Elder). Many feel that, because people are not interested in gathering wild edibles anymore, this superior entity has become angry and has taken away these foods that are being wasted. "I was taught to ask permission to nature before taking anything. Now people do not have much respect and that is how God gets angry" (Mapuche female Elder). The same supernatural punishments were also described

as occurring because people have overharvested wild edible plants for commercial purposes. "Not every year are there *piñones* because they depend on God and on how people behave in the mountains" (Mapuche female Elder). Many community members believed that wild edibles should not be sold; they should only be gathered for personal consumption and for sharing with kin and neighbors. Underground wild edible plants like wild potatoes (*Dioscorea* sp.) are owned by entities or people that live in the "underground" as another level of existence. Encountering a wild potato plant was a sign of good luck, but these plants were not supposed to be harvested.

Wild Edibles: A Children´s Domain

The small number of children in the community was another factor mentioned by adults for both not gathering wild edibles as often as before and the disruption of plant knowledge transmission. As in many other parts of the world, children used to walk in the woods looking for wild foods and medicinal plants at the request of their parents and sometimes just for fun and exploration (Setalaphruk and Price 2007; Stross 1973). "As a girl, I used to walk around the forest looking for everything [edible]" (Mapuche female Elder). In the past, children were mostly sent to the forest with specific tasks if they were not too young. These tasks included bringing back light firewood for use as kindling or looking for edible plants.

Several studies have shown that gathering is often combined with play with other children (Cruz-García 2006; Rogoff 1981; Setalaphruk and Price 2007). Forests were frequently described by many as a place of entertainment and discovery, as they used to eat wild plants that they encountered. Throughout the year, children walked to school through paths crossing fields, streams, and patches of forests. Eating wild edible plants picked on the way to school was also commonly reported. "As a child, we ate *copihue*. On the way to school, we always found them out there" (Mapuche female Elder). Children also used to gather wild edibles during school breaks near the school´s surroundings. For children, walking to school, fetching water from nearby rivers, or herding animals were times for foraging on wild edibles that they came across along the way. In the past, when autumn arrived, some children used to be sent for a couple of weeks to camp in the higher Andes and gather *piñones*, with parents visiting them every now and then to bring down a load with horses.

Conclusions

In the participating community, the use of wild edible plants is a living connection between the landscape and its dwellers, not just a source of food or income (ATree 2010; Berkes 2012). Here, knowledge of wild edible plants is still alive among most adults and elders. Some species are still gathered, but, for most wild edible plants, individual-plant relations built during childhood remain as living memories, even for species that are no longer widely used. Despite the wealth of knowledge held by most adults and elders, knowledge transmission is being interrupted as younger generations are failing to learn what the elders once learned. According to Zent (2009:112), this "delearning" trend is expected under conditions of rapid social and environmental change.

The history of land grabbing has deeply impacted Mapuche society socially, ecologically, economically, and spiritually (Toledo Llancaqueo 2006). According to Armesto et al. (2001:870), "the history of land tenure of indigenous lands can be summarized as a gradual process of seizure by the Government and by private investors." Currently, the Mapuche people are reclaiming their rights to their ancestral territory more than ever in what the governments and the media have dubbed "the Mapuche conflict" in an attempt to criminalize their struggle. The community that we worked in is in litigation to protect its rights to certain sacred places and current regimes of land tenure emerge as key to understanding current traditional knowledge transmission and food systems.

Because Mapuche pedagogy is oral and in situ, tasks and skills are taught in the places where they are to be undertaken (Ruddle 1993). For Mapuche families, intergenerational gathering trips and storytelling were essential for knowledge transmission. Land loss and the school regime have left younger generations without the opportunity to engage in these forms of indigenous pedagogy. Private property has limited people's access to many gathering sites that used to be spaces of teaching and self-learning environmental skills and cultural values. This knowledge erosion was also explained by the decreased time that children and youngsters engage in outdoor activities with elders and peers as a result of time spent at school.

Traditional ecological knowledge substantiates claims of authority over land, especially in the case of ancestral land claims and counter-claims from outsiders (Berkes 2012; Haraway 1988; Shackeroff and Campbell 2007). The documentation of local knowledge can, therefore, have long-standing benefits, as they can be used to inform and enrich baselines for communities' interests (Wyndham 2004:13). In-depth ethnobotanical documentation can also reinforce communities' land claims, struggles against development projects, conservation and revitalization projects of indigenous cultures, local youths' education, and intellectual property claims (Berkes 2012; Wyndham 2004). Through documentation and the reconstruction of stories in relation to past human-plant relations, this research can serve to acknowledge how these relations, food, and knowledge systems have changed over time and what can be done to conserve the use of wild edible plants and promote intergenerational continuity of knowledge. Local revitalization projects of wild edible plants can begin with the goals of reviving traditional food collection and preparation, particularly in collaboration with youth, and by encouraging vertical and horizontal transmission of traditional practices within local schools and community spaces. This highlights the need for formal education programs to incorporate knowledge of local resources and traditional food practices into their curricula, and to integrate indigenous pedagogies and social institutions, such as elders, for these purposes. This research attempts to contribute to this diverse range of issues, even if only in a small way.

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