Culture, Gender, and Flavour in the Conservation of Chile Pepper in Mexico, 1970s-present

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DECLARATION

This thesis is the result of my own work and includes nothing which is the outcome of work done in collaboration except as declared in the preface and specified in the text.

It is not substantially the same as any work that has already been submitted before for any degree or other qualification except as declared in the preface and specified in the text.

It does not exceed the prescribed word limit for the History and Philosophy of Science Degree Committee.

SUMMARY

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Chile peppers (*Capsicum spp*) connect worlds through their primary characteristics: flavour and spiciness. As a crop that has shaped cuisines, tastes, and intercultural exchanges throughout the globe, chiles are linked to identities, symbolisms, senses, and emotions. Therefore, chiles are ideal vehicles for reflecting on diversity and tradition, understanding how these concepts are framed, who validates them, who maintains them, and with what practices they are maintained. In this thesis, I explore how chile conservation has been led and shaped in Mexico in the last forty years by communities such as agricultural scientists, ethnobotanists and agroecologists, policy makers, and women cooks or *cocineras.* The thesis reveals how conservation historically has been institutionally envisaged and enacted and offers alternative pathways for conservation amid growing socio environmental crises.

The dissertation makes two main contributions. First, it adds to existing historical research on agricultural science and crop conservation in twentieth-century Mexico by accounting for how gendered knowledge, such as the culinary expertise of Mexican *cocineras*, has been excluded from successive projects of agricultural development. These projects include both those linked to the Green Revolution, as well as the counter-movements which developed within ethnobotany and agroecology as a response to the industrialization of Mexican agriculture. Second, this work shows that other modes of relating to and caring for crops – in this case those carried out by women *cocineras* – enact practices that are vital for the preservation of biocultural diversity and the attainment of food security. Therefore, this thesis offers a reminder that ultimately women and their culinary and embodied practices have sustained chile diversity – and with it, Mexican lifeways – even as other actors and institutions claimed this responsibility.

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LIST OF ACRONYMS

CBA	Basic Food Basket
CBD	Convention on Biological Diversity
CGIAR	Consultative Group on International Agricultural Research
CIMMYT	International Corn and Wheat Improvement Centre
COLPOS	Postgraduate College
CONABIO	National Commission for the Knowledge and Use of Biodiversity
CONACYT	National Council for Science and Technology
CONASUPO	National Company of Popular Subsistence
CONEVAL	National Council for Evaluation of Social Development Policy
COPLAMAR	National Plan for Depressed Areas and Marginalised Groups
DIF	Program for the Integral Development of Family
ECOSUR	Colegio Frontera Sur
ENA	National School of Agriculture
EZLN	Zapatista Army of National Liberation in Mexico
FAO	Food and Agriculture Organisation
GATT	General Agreement on Tariffs and Trade
GR	Green Revolution
IBPGR	International Board for Plant Genetic Resources
IIA	Agricultural Research Institute
INI	National Indigenous Institute
INIA	National Institute for Agriculture Research
INIFAP	National Institute of Forestry, Agricultural and Livestock Research
INN	National Institute of Nutrition
IPN	National Polytechnic Institute
IR-4	Inter-Regional Research Project Number, US Department of Agriculture
LBA	Living Biocultural Archive

MAP	Mexican Agricultural Program
NAFTA	North American Free Trade Agreement
OEE	Office of Special Studies
PAN	National Action Party
PAPIIT	Program for Research and Technological Innovation Projects
PRI	Institutional Revolutionary Party
PROCAMPO	Programme for Rural Support
PRONACE	National Strategic Programmes
PRONASE	National Seed Producer
SEMARNAT	Ministry of the Environment, Natural Resources and Fisheries
SIAP	Agri-food and Fisheries Information Service
SINAREFI	National System of Genetic Resources for Food and Agriculture
SNICS	National Seed Inspection and Certification Service
SOMEFI	Mexican Society of Plant Genetics
TAT	Traditional Agricultural Knowledge
TEK	Traditional Ecological Knowledge
UACh	University of Chapingo
UN	United Nations
UNAM	National Autonomous University of Mexico
UNCTAD	United Nations Conference on Trade and Development
UNESCO	United Nations Educational, Scientific and Cultural Organization
WHO	World Health Organisation

LIST OF FIGURES

Chapter 2:

Chapter 3:

Chapter 4:

Chapter 5:

CONTENTS

Chapter 1 : Introduction

Chile peppers (*Capsicum spp*), or chiles, as commonly named in Mexico, connect worlds through their primary characteristic: flavour. As a crop that has shaped entire cuisines, tastes, and intercultural exchanges throughout the globe, chiles are linked to identities, belonging, symbolisms, nationhood, senses, and emotions. In Mexico, chile's relevance expands from subsistence and small-scale production, where chiles can be seen growing in most gardens and sold in *tianguis*, or local markets, to the colossal doings of agroindustry, which aim at meeting massive domestic and export demands. Moreover, the chile crop traverses not only markets but geographies, climates, ethnicities, classes, and palates. They highlight the importance of preference, of taste, of bodies that need to be more than just fed. As such, chiles are ideal vehicles for reflecting on diversity and tradition, on how these concepts are framed, who validates these framings, who maintains them alive today and with what types of practices. Chiles, then, touch on many corners of life. This is why this work is not about chiles but about how chiles connect avenues and questions that matter for understanding the history of crop conservation and food security, and for shaping the future of these.

This dissertation analyses the ways in which chile conservation efforts in Mexico in the last forty years have been shaped by cultural aspects like identities, senses of belonging, taste preferences, imaginaries of loss, and most importantly, by gender roles and gendered types of knowledge. I explore how these aspects have materialised in communities that participate in crop conservation, such as agricultural scientists, ethnobotanists and agroecologists, policymakers, and female traditional cooks or *cocineras.* By unveiling how chile's conservation and meanings have been constructed in and by these groups, I aim at challenging mainstream conservation histories, which have largely excluded ways of valuing crops beyond Western science and its focus on collecting genetic resources.

The main contributions of this project are two-fold. First, it adds to existing historical research on agriculture and crop conservation by delivering an account of how gendered types of knowledge, such as the culinary expertise of Mexican *cocineras* from the Zapotec community of Santo Domingo Tomaltepec, have been excluded from consideration in Mexican projects linked to legacies of the Green Revolution, as well as in the counter-movements which developed within ethnobotany and agroecology as a response to industrial agriculture. Second, drawing on the latter, this work shows that other types of relating to and caring for crops – in this case by women *cocineras* – enact practices that are vital for the preservation of biocultural diversity and the attainment of food security; in equal measure or, as I will suggest, even more so than institutional efforts. Therefore, this story inserts itself as a constant reminder that women and their culinary and embodied practices, albeit largely neglected and invalidated, were and are always there. This dissertation begins and ends with them.

Chile as a Vehicle of Encounter: A Crop, an Ingredient, a Product, an Identity

Chile's far reach makes it one of the most culturally and economically important crops in the world. Spread throughout the globe after the Conquista, chiles are not only an emblem for Mexican food but also for cuisines in India, Turkey, Italy, Spain, China, and the United States, to name a few. All chile types are contained in the genus *Capsicum*, which is believed to have originated in South America (Pickersgill, 2016). From the 40 known species, 35 are considered to be wild and 5 domesticated, namely *C. baccatum, C. pubescens, C. chinense, C. frutescens, and C. annuum* (Luna Ruiz et al. 2018). This last one stands out as the species with more domesticated varieties, most of them bred in Mexican territory, known as the centre of diversification of *C. annuum*. There are approximately 90 known domesticated *C. annuum* varieties in the country, all of which include the main commercial varieties consumed globally today, such as jalapeño, poblano, bell peppers, and more. This enormous diversity of chiles emerged from an intricate relationship between different cultures and wild chile types (in *C. annuum* wild varieties are generally known as *chile piquin* or *chiltepin*), where the fruits

acquired an important role in food flavouring but also in medicinal, ritual, and aesthetic activities (Aguilar Meléndez et al., 2021).

This mutual human-plant trajectory has been ongoing in the Americas for about 6,000 to 9,000 years, alongside the diversification of other crops such as maize (*Zea mays L*.), beans (*Phaseolus spp*), squash (*Cucurbita spp*), and tomato (*Solanum lycopersicum*), which together form the basis of Mesoamerican diets and are the main components of the *milpa*, the most used crop-growing system in the region for small production and family subsistence (Pickersgill, 2016). Being the flavour-giver par excellence in Mesoamerican diets – otherwise thought of as monotonous or "tasteless" without chile's addition (Hernández Xolocotzi, 1970; Long-Solís, 1998) – the celebration of chile as an icon of identity and "soul" of Mexican cuisine (Aguilar Meléndez, personal communication, 2022) has linked chile to imaginaries of Mexicanness and nation building discourses (Bak-Geller, 2013; Katz & Lazos, 2017; Pilcher, 1998).

As such, chile's link to Mexican identity and nationhood abounds. In everyday life chiles occupy a stellar place in language with phrases such as *"Más mexicano que el chile"* (More Mexican than chile) or *"Al chile"* (to the chile, which works as an emphasis marker), and even in popular songs like "*La Llorona*"; *"Yo soy como el chile verde, picante pero sabroso"* (I am like the *chile verde*, spicy but delicious) or "*El son del chile frito*" by Lila Downs, where she sings "*Sin chile no sé vivir*" (Without chile, I do not know how to live).

Similarly, most academic works that touch on Mexican chile start by making this connection explicit, or by signalling the elemental place this crop holds in Mexican households and dishes. Just as an example, Aguirre-Mancilla and colleagues' agricultural science paper on chile production begins with "The chile in Mexico is one of the most important crops from a cultural, agricultural, nutritional, and economical point of view" (2017, p. 19). Also, Castellón-Martínez and colleagues' ethnobotany article on Oaxacan chiles opens with "The chile crop in Mexico has remarkable social and economic importance due to its export demands and its [domestic] generalised consumption…" (2012, p. 27). Lastly, anthropologist Esther Katz starts a chapter on chile's journey to Europe with "In Mexico, chili peppers are everywhere, in markets, food stalls, industrial food, in all dishes, even children's candies, as they are eaten from an early age. The chile flavour is the main characteristic of Mexican cooking" (Katz, 2009,

p. 213). These short extracts exemplify the importance of chile as a unifying symbol of different Mexican identities, cultures, and social groups.

Research on chile's cultural and historical legacies in Mexico have mainly surged from anthropological and ethnobotanical studies in the last four decades. One of the most representative works is that of anthropologist Janet Long-Solís, particularly her book "*Capsicum y cultura: La historia del chilli*" (Capsicum and Culture: The history of chilli) (1998), where she presents an exhaustive exploration of the history of chile spanning from the prehispanic period, the Conquista, chile's worldwide distribution, its industrialisation, its uses in traditional medicinal and ritual, as well as a chile dictionary from varieties found in Mexican territory. Her *oeuvre* has been a chief constituent to chile studies, including this one.

Further important additions centred on the chile-Mexican culture liaison have explored aspects like the history of its global distribution (Katz, 2009), narratives of chile producers regarding the effect of climate change in Mexico and the United States (Friese et al., 2011), chile's lead in Mexican culinary art (Adapon, 2008), the ethnoecological interactions of native cultures and wild chiles (Vázquez Dávila, 1997), chile's diversification in relation to different languages (Aguilar Meléndez 2006), a compilation of chile's diversity in Mexico (Aguilar-Rincón et al., 2010), chile's medical and spiritual uses (Luna et al. 2018), chile as a food-medicine cultural continuum (Aguilar Meléndez et al., 2021), chile's conservation through its culturally-situated management and uses (Güemes & Aguilar Meléndez, 2020), amongst others. Moreover, two comprehensive and multidisciplinary chile-focused volumes edited by Araceli Aguilar Meléndez, Marco Vásquez-Dávila, Maria Reyna Hernández Coronado, Gladys Manzanero Medina, and Esther Katz, touch on a range of topics including their biocultural diversity, distribution, management, and conservation, chiles' gastronomic importance, their role in different cuisines like the Maya, Zapotec, and Mixtec, their archaeological evidence, and more (2018, 2021). My thesis adds to these accounts by historically linking the ways in which different social groups, especially professional researchers, have conceptualised chile's meaning in all its diversity; from Mexican kitchens, tables, markets, and fields, to academic halls, laboratories, and seed banks.

However, chile's cultural relevance is not the only celebrated aspect of this crop. In fact, chiles in Mexico exist in two main spheres: the local varieties cultivated for subsistence

consumption, or for small to medium scale production, and the industrial sector, which flourished in the Northern states of the country and that meets growing urban and export demands (Aguilar Meléndez & Meraz, 2021). Chile's economic importance as a commodity product emerged from the 1960s as part of a broader standardisation of biotypes that aimed at boosting capitalist food systems (Gutiérrez Núñez, 2017). According to the Agri-Food and Fisheries Information Service (SIAP), chile's commerce has grown up to the point that, today, chile in Mexico is one of the 5 most important vegetables in terms of yield and profit (2017). The Ministry of Agriculture and Rural Development (SADER) established in 2024 that chile production reached a yearly production of approximately 3 million tons in 2023, encompassing mainly commercial varieties like jalapeño, anaheim, *serrano,* habanero, bell, *ancho* and *árbol* (2024). This makes Mexico the fourth biggest producer in the world and one of the biggest exporters of chile, with about 30% of the national production destined to foreign markets, mainly to the United States and Canada, countries with huge Mexican migrant populations. Only last year, chile's export commercialisation returned around 1, 124 million dollars to the Mexican economy (SADER, 2024; SIAP, 2023), which reflects the role this crop holds in national agriculture, as will be discussed in Chapter 2.

Chile's pivotal place in the economic and cultural realms brings to the table its most prominent characteristics: flavour and spiciness. It is these attributes, after all, which have made chile both a highly valorised product and a local delicacy. Chile's diverse flavours and spices spark experiences of pleasure, of excitement, of consistency, and even pain, which in turn awake emotional, spiritual, and mental responses in their consumers (Aguilar Meléndez & Güemes Jiménez, 2020). These individual and collective experiences derived from chile's taste have been discussed in some of the works mentioned above and a few others, where chile's taste or *sabor* is represented as a defining factor in national cuisine and heritage (Adapon, 2008; Long-Solís & Vargas, 2005), in territories and belonging (Manzanero Medina et al., 2021; Toledo Martínez, 2018), in ethnic and national identities (Long-Solís, 1998; Ramos Abascal, 2018), and in nutritional studies alongside maize and beans (Long-Solís, 1998). Approaches from food and nutrition sciences have detailed chile's chemical composition – namely capsaicin, the molecule responsible for chile's pungency – alongside its nutritional and medical values (Lawless et al. 1985; Kantar et al. 2016; Srinivasan 2006).

Taste as an avenue of research developed more profoundly within food studies since the 1980s and more strongly in the 1990s (Sutton, 2010; Mintz & Du Bois, 2002). Despite not being directly linked to chile, these studies ground the guiding lines of flavour in this work: memory and belonging.[1] In this regard, food scholars have addressed taste as a multisensory experience that includes temperature, textures, sounds, aromas, and colour, rather than the sole capacity of categorising flavours (Cárdenas Carrión, 2013; Sutton, 2010). This integral approach has connected flavour and the entirety of the sensing experience with the construction of identities (Law, 2001; Pilcher, 1998), with the relationship of senses to memory and materiality (Holtzman 2006; Seremetakis 2019; Jordan 2015), with place-making (Duruz, 1999; Ma, 2018), with flavour as a marker of social transformation (Mintz, 2003), and with senses as epistemological tools that also expand our understanding of other cosmologies (Cárdenas Carrión, 2013; Stoller, 1989).

Building on this scholarship, in this work I analyse chile's flavour and spice through the lens of memory, senses of belonging, and embodied *savoir-faire* to show how different knowledge groups assign value to this crop. As such, it is pertinent to provide context on how value has been discussed in the literature and how it will be approached throughout this thesis. The concept of value has been explored by anthropologists, especially in relation to the semiotic, cultural, and collective constructions of meaning found in diverse qualities, actions, practices, or objects. For one, by exploring the relationship between virtue and value, Michael Lambek discusses ethical values as functions of acts – not only of objects – that, informed by virtues, go beyond *doing* to ways of *being* (Lambek, 2008). Drawing on the idea of values as acts rather than only abstract representations, culturally conventionalised practices convey meanings in which people rely on to interpret and relate to the world (Harkness, 2013, p. 15; Robbins, 2015).

[1] For histories of food and taste with a broader scope see Spackmand and Lahne (2019) for how senses carry economic value, Ayora-Díaz (2021) for a history of food transformation in Mexico, Freedman (2007) for a global history of taste and cuisine, Bartoshuk for a history of taste research (2012), Gigante (2008) for a literary history of taste, and Anderson (2023) for a history and natural history of world spices.

Moreover, values can also be shaped by the type of activity that is performed when assigning meaning to something. Anthropologists Frank Heuts and Annemarie Mol (2013) present a case where the value of tomatoes is defined by different expert groups (namely developers, growers, processors, cooks, and consumers). Here, they show that the conceptualisations of value are informed by the type of activity (growing, selling, cooking, eating) that each group engages with, and argue that valuing does not depend on fixed variables (2013, p. 141). That is, a "good tomato" might be something different to a cook than to a grower. In this dissertation I will follow Heuts and Mol's approach to explain how different groups portray chile's value whilst also highlighting the broader cultural and semiotic conventions of chile in Mexico.

In this sense, chiles are much more than just a crop. Chiles in Mexico connect to a dynamic and complex network of historical and cultural legacies, vehicles of sensorial experiences, values, memories, and emotions. As Sutton puts it "…culturally shaped sensory properties and sensory experiences of food are invested with meaning, emotion, memory, and value" (Sutton, 2010, p. 220). This contrasts the historically built hierarchical structure that prevails in conservation and research practices. For one, the framing of crop genetic resources, as the name suggests, has been primarily concerned with the economic and utilitarian aspects of crops, setting aside culturally relevant attributes (Fenzi & Bonneuil, 2016). Under this logic, scientific and academic knowledge are still conceptualised as more valid than embodied practices and local epistemologies. Therefore, this story not only offers a critical view of crop conservation histories, but also offers a space where stories, memories, and emotions are compelling elements in the formulation of a crop's value beyond that of genetic resources.

Histories of Conservation and Food Policy: Is Chile a Forgotten Crop?

At this point, one could establish with certainty that chile has historically occupied a central role in Mexican cultures, diets, cuisines, and economy. Moreover, that chile serves as an analytical vehicle of encounter between worlds. Product and landrace; nation and identity;

senses and knowledge; memory and seed; science and cuisine; diversity and standardisation; *saber-hacer* (know-how) and research. The borders of such categories blur and, in some cases, intersect when we take a closer look at chile's conservation trajectory. Interestingly though, the history of chile conservation has not yet been explored within a comprehensive and exhaustive account despite the relevance that Mexican agriculture and crop conservation have had in academic scholarship from the 1970s.

Histories of agricultural science and crop conservation in Mexico have explored the country's collaboration with the Rockefeller Foundation from the 1940s until the 1960s through the "Mexican Agricultural Program" (MAP), which outlined what became the so-called Green Revolution and the development of what came to be conceived as high-yielding and monocrop agricultural science. Scholarship on this topic has mainly focused on the technification of agriculture and the standardisation of biotypes (Caire-Pérez, 2016), the ways in which the GR transformed plant breeding (Baranski, 2022), its socio-environmental consequences (Wright, 2005), scientific external aid initiatives (Harwood 2009), the material and intellectual circulation of scientific expertise (Barahona, 2013), the institutionalisation of agricultural scientists in Mexico (Cotter, 2003), and the development of seed conservation facilities amidst imaginaries of loss, mainly seed banks (Curry, 2019). This dissertation will add to these accounts by integrating into this established literature the history of gendered patterns of recognising knowledge that has been generally overlooked.

The far-reaching eventualities of the collaboration between the Mexican government and the Rockefeller Foundation, and the histories of social resistance that emerged since, have placed Mexican agriculture, scientists, government, and food producers at the centre of broader historical debates regarding the geopolitical, environmental, and social consequences that industrial agriculture has had in the world from the second half of the twentieth century until today. In other words, Mexico has been a paradigmatic site where scholars, like myself, have thought about global issues that connect with agrobiodiversity in all its amplitude, and a lens from where to understand other places.

Early but paramount critiques of the Green Revolution emerged in the 1970s and 1980s as counter narratives that aimed at dismantling the discourse on progress and modernity promoted by industrial agriculture supporters. Whilst the latter's proponents

framed technological packages and associated technologies such as fertilisers, chemicals, and improved seeds as the sole viable option for world hunger and food supply, some scholars and activists denounced these interventionist strategies as detrimental to the environment, rural producers, and peasant communities. These counterclaims urged a more just and responsible valorisation of the practices, seed diversity, and knowledge of farmer communities, along their well-being (Feder, 1975; Fitzgerald, 1986; Hewitt de Alcántara, 1976; Jennings, 1986; Kloppenburg, 1988; Nabhan, 1985; Hernández Xolocotzi, 1970, 1981; Suárez, 1982; Wright, 1997). In like manner, authors warned of the consequences that the end of food self-sufficiency in Mexico would have on the rural crisis and the peasant struggle, as well as on the nutrition and health of the population, ironically linked to promises that GR ideas did not fulfil (Barkin & Suárez, 1985; Esteva & Barkin, 1980).

Critical counter studies grew considerably in the following decades, especially with the growth of neoliberal policies and treaties in the 1990s such as the North American Free Trade Agreement (NAFTA), which furthered the growth of globalised industrial agriculture systems and the standardisation of biotypes (González, 2019; Gutiérrez Núñez, 2017). These more recent accounts on Mexican agricultural history were less poignant but more specific in approaching the inadequacy of the MAP and follow-on programmes for the Mexican rural context, the broader socio environmental consequences of the GR and its capitalist legacies. For one, histories of the institutionalisation of Mexican *agrónomos* (agricultural scientists) have set the ground for understanding the crossings between the making of a profession, foreign influence, and the pursuit for rural modernization. This has added a valuable insight to understanding the long-standing rifts between scientists and *campesinos* (peasants) and the neglect of the latter's agricultural knowledge and needs, a problem deeply rooted within the history of the Mexican state (Cotter, 2003).

This rift between peasant and indigenous peoples and the Mexican state has been evidenced in the government's pursuit of transnational agri-food policies that promoted grain imports and the export of seasonal and profitable crops. The consequences of neoliberal policies have been accounted for in studies that analyse the processes of commodification and standardisation of Mexican diets, which skyrocketed in the last three decades (Lind & Barham, 2004). These contributions have detailed the complex detrimental effects in the

population's health and nutrition, the complex crossings between industrialised diets (and therefore high in sugars and saturated fats) and traditional foodstuffs (Gálvez, 2018; Nabhan, 2004). Also, they have explored the forces of exclusion propelled by the Mexican state, such as the halt of welfare investment in the countryside, which instigated rural migration to urban centres and to the United States (Durand, 2017).

Such stories have also aimed at debunking long-standing conceptualisations embedded in early indigenist and modernising nation-building discourses (Dillingham, 2021), where peasant and indigenous agriculture knowledge and practices were framed as backward or inefficient (Soto Laveaga, 2018). Tracing how the framework of Western science and ideas of advancement shaped ideas about crop landraces, scholars have also explored the standardisation of biotypes and their connection to the Mexican modernisation project, one where the mestizo race would inevitably dilute the heterogeneity of indigenous groups and forward a homogeneous, modern nation (Hartigan, 2017; Wade et al., 2014).

Within the historical groundwork of high-yielding agriculture and plant breeding, scholars have sought to understand how worries about the loss of crop diversity materialised in what came to be long-term preservation of crop genetic diversity. Whilst the replacement of crop landraces for improved seeds and monocultures was a desired outcome in the expansion of industrial agriculture, crop erosion became a by-product of the Rockefeller Foundation's interventionist agricultural activities in Mexico and eventually in other regions of the world. Historical approaches have delineated how the Rockefeller Foundation's involvement in the collection and conservation of crops emerged as a response to its own doings, making the organisation, ironically, a world leader in crop conservation programmes and facilities (Curry, 2017b).

In this line of work, studies on *ex situ* crop conservation efforts have outlined the creation of networks of seed banks in the 1960s and 1970s by international organisations such as the Food and Agriculture Organisation (FAO) and the Consultative Group on International Agricultural Research (CGIAR). In 2008, the ultimate conservation facility was inaugurated in Svalbard, Norway, which promised to safeguard all world seed duplicates. These perceptions of seed banks as safe technoscientific repositories have been challenged by scholars who unveil the intricacies in establishing "copying as a solution" rather than re-formulating

conservation values and guidelines that ultimately address diversity loss in the ground, fair accessibility of resources, and an equitable care of commons (Chacko, 2018; Curry, 2019, 2022a, p. 667; Fenzi & Bonneuil, 2016; Peres, 2016; Saraiva, 2013).

On the other hand, a growing body of literature within history, anthropology, ethnobotany, and environmental studies has focused on *in situ* or situated conservation, and especially, on the ways in which the value of crop landrace diversity goes well beyond that of genetic resources. Most of these accounts dig into the ways in which Traditional Agricultural Knowledge (TAK) and Traditional Ecological Knowledge (TEK), led and perpetuated mainly by local and indigenous groups, have forwarded multi-crop farming systems that in turn enhance biodiversity (Angé et al., 2018; Nazarea, 2005; Toledo, 2001; Toledo & Barrera-Bassols, 2008). The continuous existence of local landraces, despite the challenges imposed by global agriculture, speaks of peoples' connection to their crops, to their seeds' ecological resilience and adaptability, to their biocultural heritage, to food preferences, to their affective and emotional components, and as established above, to taste and belonging, something that in many places matters more than yield and production (Nazarea, 1999; Toledo & Barrera-Bassols, 2020). Some of these works have explored biodiversity conservation in places such as house-gardens (Howard, 2003; Nazarea & Gagnon, 2021), traditional farming systems like *milpas* (Bermeo et al., 2014; Mateos-Maces et al., 2016), and in community seed banks (Aragón Cuevas, 2011; Nazarea et al., 2013).

Hereof, the recognition of the multiplicity of ways in which peoples relate to their crops, to their environment and to their territories has opened avenues of discussion around how to change institutions and policies to tackle urgent social, environmental, and climate crises. Histories of bioprospecting and the difficulties of pairing capitalist economies with conservation have revealed the many contradictions that emerge in these processes (Hayden, 2000). Similarly, researchers have analysed the convoluted nature of property and intellectual rights of crops and the disparate consequences in different agricultural communities (Sherman & Chapman, 2020), as well as the need of reforming nature-human relational values beyond economic utilitarianism under a pluralist approach in natural resource governance (Pascual et al., 2017).

When zooming into individual crops, it is not very surprising that maize has been situated at the centre of Mexican agriculture, food, and conservation histories. Maize is the most important grain in Mexican and Mesoamerican diets and represents the caloric base of the country's nutrition. For such reason, it has been the case study for analysing transformations of Mexican agriculture during the twentieth century (Gutiérrez Núñez, 2017), the legacies of neoliberalism and the marginalisation of *campesinos* in rural Mexico (Fox & Haight, 2010), debates and complications with transgenic corn and their social implications (Fitting, 2011; Kinchy, 2012), food homogenisation and health sequels under neoliberal policies (Gálvez, 2018), the social construction of crop races (Hartigan, 2017), trajectories of loss and extinction that shaped conservation strategies (Curry, 2022a), amongst others.

The pivotal role that maize – and grains more generally – have as the main calorie providers for the population places them as irreplaceable elements of the diet, and, quite understandably, at the centre of research and policy. Yet, this means that many other crops remain unexplored in historical and social studies, particularly with regards to conservation and the construction of food systems. More so, little has been written about food security beyond grains. As I will argue throughout this work, chile has been overlooked in conservation efforts primarily because it is not perceived as caloric, despite its nutritional benefits such as vitamins. However, its position is key to explore crossings between food security and food sovereignty as, even if not a grain, it remains a staple. Chile is basic for Mexican diets in terms of preference but not basic in terms of calories. Therefore, the recent history of chile conservation brings an interesting question to the table: What can culturally basic crops like chile tell us about what is missing in food and conservation policies?

Food security and sovereignty have been well explored in the literature. The former has been generally linked to institutional and governance policies aimed at securing people's sufficient caloric intake from the 1970s. The latter, even if a contested and over defined concept, has been described by La Via Campesina as "the right of each nation to maintain and develop its own capacity to produce its basic foods respecting cultural and productive diversity" (Patel, 2009). Food sovereignty developed within grassroots and activist movements in the 1990s as a response to the limitations of the concept of food security. Ongoing impoverished conditions in food producing and rural communities persisted around

the world albeit states and organisations' promises of equality and improvement, especially in developing countries.

As both concepts have evolved through the years, scholarly debates have inquired into their definitions and meanings, their points of encounter, incommensurable separations, and the potential solutions to move forward in food policy, both at international and regional scales (Beuchelt & Virchow, 2012; Carolan, 2013; Edelman et al., 2014; Jarosz, 2014; Mechlem, 2004; Patel, 2009). In the Mexican context, scholarship has critically examined the paternalistic policies of the Mexican state through the twentieth century, where the adopted strategies on food security relied on grain imports, and a slow transition from subsides to welfare programmes dedicated to the poorest sectors of society (Gálvez, 2018; Herrera, 2009; Ochoa, 2000; Rubio & Pasquier, 2019; Sandoval & Meléndez, 2008).

Rather than solving the crossings between both concepts, this work will focus on delivering an account of how chile's complex positioning as staple but non-caloric, symbolic, nation-building and flavour-giver crop, sheds light into Mexican food and conservation policies and why and whom they have failed. In this sense, this work will explore what voices and practices have been validated and which ones invalidated in the making of conservation efforts and food security policies. As mentioned before, this will be done by constructing a story from different perspectives according to groups involved in chile research and conservation. To develop this story, I engaged in archival research and oral histories to account for the institutional and academic aspects of chile and the actors involved, namely scientists and academics. Yet, as research moved on and I actively participated in a food sovereignty project, I visualised the limitations of these methodologies. To integrate voices beyond institution halls and knowledge beyond what is written, I chose to incorporate the use of collaborative and participative practices in a conservation space that is often overlooked in food and conservation histories, and where the body has a lot to tell: the kitchen.

As all the above shows, crops and their relationship to agriculture, nature, people, culture, and, of course, conservation, have been covered in the literature broadly and extensively for at least four decades. Yet, there remains space in the literature to further question how gendered knowledge, and cultural aspects of crops such as flavour and

belonging, have an impact on conservation strategies and food systems. It is for these reasons that I turn to chile: not to describe a history of chile as an individual crop, but rather as a case study that brings light into what has been missed in the practice and history of crop conservation and research. In this sense, this work brings about a more inclusive interpretation of crop conservation and research than that offered by mainstream histories on agriculture and crop conservation, and very importantly, of how conservation can look like.

Conservation from and by Women; Kitchens as Conservation Hubs

If we think about histories of women's culinary knowledge and the connection of this knowledge to science, these seldomly portray women as agents of conservation. There are even fewer histories of crop conservation that have entered the kitchen and engaged with bodily, sensual, and community experiences to tell better, more informed narratives. Hence, in this project I decided to go into the kitchen myself and collaborate with expert *cocineras*. I did so mainly because if we as historians do not tell conservation from other places and perspectives beyond academic halls, seed banks, and state-led institutions, we will be missing where it is remarkably effective: in house-gardens and local plots, in grandmothers' unwritten recipes cooked through generations, in the daily salsas that accompany our plates and souls.

Whilst taste and cooking have been long recognised as crucial activities for crops' domestication and diversification (Hernández Xolocotzi, 1970), the link of these activities with gendered knowledge and biodiversity conservation was not really forged until the late nineties and early twenty-first century. These heterogeneous but limited set of works have acknowledged women's culinary knowledge and kitchens as conservation hubs from different angles and fields of knowledge. For one, Lucía Pérez-Volkow and colleagues explored the ways in which Lacandon Maya women's knowledge on traditional foods can enhance biocultural restoration (Pérez-Volkow et al., 2022), geographer Laurie Greenberg delineated how women's knowledge in house-lots and food preparation promotes crop conservation in Maya immigrant communities (Greenberg, 2003), and the FAO recognised rural women as

preservers and managers of biodiversity in its book “Higher agricultural education and opportunities in rural development for women: An overview and summary of five case-studies” in 1997.

Yet, overall, an explicit connection between kitchens, women’s culinary knowledge, conservation, and their intersections, has not been made widespread in the literature. In the process of exploring the history of chile research and conservation, it became evident that for the most part, local and indigenous women’s role and knowledge on chile was missing. As detailed in Chapter 4, even when women’s knowledge was finally recognised in recent chile ethnobotanical research, the gap persisted in food policy and conservation programmes. In this dissertation, I highlight this exclusion and argue that it has had two direct results. First, it has perpetuated inefficient, elitist, and exclusive conservation programmes and food policies. Second, it has obscured many practices and conservation pathways that are still alive and thriving. In other words, by ignoring women, institutions have failed to bridge existing local networks of biocultural conservation with state and academic projects, thus frustrating attempts at creating more collaborative and participative food security and conservation schemes. This history of chile makes visible this exclusion and therefore adds to contemporary accounts of women in food studies and conservation.

Even when the connection of women’s culinary knowledge to crop conservation is still an area to be further explored, accounts on women’s agricultural and culinary knowledge, and their role in food systems, are vast and have been mainly rooted within feminist theories or inspired by these. For one, the connection between food sovereignty, food justice, and gender, has been a well-investigated avenue within peasant and rural studies. Here, women’s highly specialised but often under recognised TEK has been proved as essential in food provisioning, production, and preparation, details that have been systematically overlooked in agricultural, policy and economic analyses and often attributed to peasant men (FAO, 1996; Grey & Patel, 2015; Sachs, 2018; Turner et al., 2022). More so, women’s crucial role in forging food sovereignty has been recognised by describing the ways in which they sustain food systems in their own territories, but also, in how their political agency and mobilisation has shaped movements towards a global struggle for food justice, particularly in the Global South

and in local and international organisations, such as La Via Campesina (Desmarais, 2003; González Torres & Pachón Ariza, 2022; Navin, 2015; Vivas, 2012; Urretabizkaia, 2020).

More so, scholars interested in seed saving, heirloom varieties, and feminist theories in relation to these have developed several accounts that aim at deconstructing the patriarchal lens that dominates the world of seed banking and institutional crop conservation programmes. For one, the concept of seed and its gendered implications in reproduction have been challenged to integrate the matrilineal and queer connections of seeds, plants, and humans within their multi-species relations (Chapman & Chacko, 2022). In this line, academics have noted that the relationships between farmer communities and their seeds are built through affective, spiritual, and material components, ones that are mostly invisible for scientific and political institutions, ones generally focused on market-driven production systems (Chapman, 2022). As such, the reframing of concepts like "repatriation" of seeds into "rematriation" has been relevant to turn the emphasis on nationhood and patriarchy to an inclusive term that allows for emotional, spiritual, and physical bonding of people with heirloom seeds and their territories (Kutka et al., 2022).

In recognising the physical and metaphysical connections between humans and their heritage seeds (and therefore, plants), anthropologists and historians have accounted for the ways in which seeds and territories are vehicles and enablers of memory and identity (Nazarea, 1999, 2005, 2006). This is closely connected to taste and the senses as instigators of memory and cultural belonging within food and memory studies, as described above. Together, these reflections have signalled the importance of acknowledging the power of memory and local types of knowledge along their embodied, emotional, and spiritual instances in relation to biodiversity. In words of acclaimed food and memory scholar Virginia Nazarea "…it is important to acknowledge a powerful counter in marginal fields and uncaptured spirits" (2013, p. 22). These approaches have evidenced the ways in which women's actions in seed saving and gardening promote biocultural conservation (Sachs, 2006) within their own value systems, ones that have been maintained and perpetuated despite the recent homogenisation of lifestyles.

Adding to the above, in this work I consider culinary practices as enablers of memory. The knowledge embedded in memories and embodied experience allows for recovery and

perpetuation. This in turn is crucial for networks of use of many crops, ingredients, recipes, seeds, and other elements of food systems, themselves part of biocultural heritages.

The connection between food, gender, and tradition has been also a matter of significant scholarship, particularly within critical heritage studies. Traditional foods have been described by anthropologist Bridgette Sebastiá as "providers of personal or collective identities, and markers of social and cultural representations as varied as aesthetics, pleasure, ethics, memory, politics, lifestyle and well-being" (2017, p. 6). Signalling its multi-layered and changeable nature, Sebastiá's definition helps to unveil the complexities that emerge with labels such as "authentic" or "original" foods. Whilst ethnic or traditional foodstuffs have largely been conveyed as paramount for the protection and continuation of biocultural heritages (Long-Solís & Vargas, 2005; Sebastiá, 2017), academics have also noted the risks of essentialising or romanticising "the traditional" and the people who enact these practices (Bak-Geller et al., 2019). Women, as main carriers of culinary knowledge in many places in the world, are primary subjects to these dynamics.

The process in which cultural and immaterial patrimony is linked to local/traditional foods and then to market forces is often referred to as heritagisation (Grasseni, 2011). The case of Mexican traditional food is particularly enlightening since, as a globally acclaimed gastronomy, it has been subject to heritage projects in all scales: from international heritage protection schemes such as the United Nations Educational, Scientific and Cultural Organization (UNESCO) with Mexican food in 2010, to nation building projects, to local cultural reappropriation projects, amongst others. Yet, as social scientists have shown, heritagisation processes can bring about different and even contradictory results to local populations. For one, there are cases where heritage projects have caused the exoticisation, exploitation, and commodification of local peoples and their foodstuffs when led by elites, whilst preventing locals from reaping the socioeconomic benefits (Suremain, 2019). However, other examples of situated collective endeavours show how local populations can use heritagisation processes to attain political or economic leverage or autonomy (Bak-Geller, 2019; Vizcarra Bordi, 2006), or to reaffirm identities in the case of migrant or displaced communities (Littaye, 2016).

In line with the above, it is important to note that the denomination of *cocineras tradicionales*, or as I will use throughout the text, *cocineras*, is part of the recent heritagisation of Mexican food. Whilst the term is used to refer to women with indigenous heritage who carry, practice, and perpetuate ancestral traditional culinary knowledge, critical heritage scholars have pointed out that the concept was externally constructed under a market-oriented lens by institutions such as the Mexican government (Cortés et al., 2020; Matta, 2019). This connection of *cocineras* to "authentic" Mexican food has mostly benefited touristic and economic interests in both public and private sectors. Even when the concept of *cocineras* is often used to convey respect and legitimisation of their knowledge – which is relevant for the recognition and empowerment of local and indigenous cooks – it is important to question how it can lead to a just redistribution of wealth under a capitalist logic (Matta, 2019).

In this dissertation, I will use the term *cocineras* to convey the social recognition, authority, and expertise that women of the community of Santo Domingo Tomaltepec hold over their food pathways. I will do so aiming at not romanticising nor essentialising their knowledge, embracing the idea that tradition is socially constructed and forever changing. This decision was reached due to the meaning the word holds in the community and to the use of the concept by the project Cocina Colaboratorio, where the author collaborated for this work's fieldwork. Yet, I will do so acknowledging the complexities that the term implies and that have been expressed by critical heritage scholars.

More so, it is important to recognise that culinary practices do not occur in a void. Places where these activities happen, such as kitchens and house-gardens, and public spheres such as plazas, markets and *tianguis*, have gained visibility in scholarly accounts that approach them as places where women exert their expertise and where knowledge is constantly produced, and traditions transformed (Abarca, 2006; Christie, 2004, 2006, 2008; Law, 2001; Roldan Rueda et al., 2016; Schroeder, 2006). These spaces, where cooking and community building take place, have been defined by Maria Elisa Christie as kitchenspaces, meaning the "combination of indoor and outdoor spaces where food is prepared, is a privileged site of cultural reproduction and plays a central role in family and community life" (2004, p. 370). Kitchenspaces, then, have been analysed by critical food and heritage scholars as private,

semi-public, and public environments where the preparation of food is central for strengthening social relations. In this respect, gendered culinary knowledge and the dynamics that take place in kitchenspaces become not only acts of physical nurture but of care, celebration, social cohesion, ritual, and of strengthening senses of belonging (Christie, 2004). Kitchenspaces and cooking, then, can be conceived as sites of women's expression, creativity, creation of knowledge, as well as places where reciprocity networks are forged.

Therefore, it is important to acknowledge that *cocineras'* practices and knowledge have been shaping food systems for centuries, much longer than the global endeavour of collecting genetic resources. Yet, some of the layers where women enact their knowledge and expertise are not usually linked together in food policies nor conservation efforts. Some of the different layers women work through go from food production and preparation, conservation of crop and plant varieties, perpetuation of heritages, to family union, connection to territories, community building, networks of affection and systems of care.

This *saber-hacer*, or know-how, intrinsic to culinary cultures, has been historically overlooked and minimised by academics and stakeholders as part of a Western and modern legacy. The dichotomic approach stemming from this intellectual tradition separated the *saber-hacer,* or embodied knowledge, from the mind, or the know-that (knowing that something is the case), elevating the latter as a superior way of knowing (Abarca, 2006; Heldke, 1992; Stoller, 1989). Whilst contemporary philosophical debates still discuss the distinction and relevance of both modalities (Beaney, 2023; Fantl, 2008; Stanely & Williamson, 2001), authors in the social sciences have expanded accounts of the knowing body as valid, essential, and necessary for an integral comprehension of the world. Especially, in the case of racialised non-Western women, whose knowledge – both embodied and theoretical – is often minimised or overlooked as "simplistic" (Twagira, 2021).

Therefore, one last but crucial body of literature to include in the base ground of this work is that of decolonial feminisms from *Abya Yala*[2], and the substantial contributions they have developed in the topic of care. The decision to include them instead of other branches

[2] Abya Yala refers to the American Continent and derives from the Kuna language. This term is used by scholars and social movements that defend a decolonial denomination of the continent.

of feminism and decolonial studies comes from a political and ethical standing of representing women from the Global South – especially racialised women – not only as objects of study, victims, or agentless subjects, but rather as knowledge producers, intellectuals, and activists that have been contributing knowledge producers all along (De Sousa Santos, 2009; Gargallo, 2013; Zapata, 2013), and who are often forgotten by academic accounts. Critical and decolonial feminisms can be found in the work of indigenous, mestiza, and/or afro-descendant intellectuals such as Sylvia Rivera Cusicanqui (1979, 1987, 2010; Rivera Cusicanqui & Platt, 1978), Ochy Curiel (2002, 2007, 2018), Aura Cumes (2009a, 2009b, 2012), and Lorena Cabnal (2010, 2013, 2017). These scholars have denounced the failure of academic feminisms (both in the Global South and in the West) to integrate intersectional perspectives that acknowledge race, class, and capitalism as crucial elements that affect women in patriarchy, beyond urban-middle class and white lifestyles.[3]

In emphasising the historical erasure of non-Western epistemologies in Modernity, this avenue of thought calls for a feminist project that recognizes plural modernities and collective ways of living (Gargallo, 2013, p. 23; Segato, 2013). According to Rita Segato, it is necessary to deconstruct the binaries imposed by colonial epistemologies which deepen divisions between Western-indigenous, subject-object, white-racialised, reason-body, public-private, woman-man, market-community, and that perpetuate the violence of bodies and territories that do not accommodate to the established capitalist-modern hierarchy (Segato, 2013). Here, Segato signals that it is in the implementation of these binaries that the domestic, and therefore much of women's labour and systems of care or *cuidados*, have been de-politicised and rendered invisible. This is certainly the case for women's culinary activities and their role in biodiversity conservation, where their work and expertise often fall into oblivion in conservation efforts.

Feminist scholars specialised in politics of care have analysed how capitalist societies have been sustained by women's disparate social responsibility in reproduction, in supporting family and household, and even in providing affection (Federici, 2011). Care, as a set of life-

[3] For more literature on Latin American decolonial theories see Anibal Quijano "*Colonialidad del poder, eurocentrismo y América Latina*" (2000).

sustaining activities, has been defined as a way of attending or nursing people and territories under different systems of provision in matters like food and nutrition, health, education, housing, water, territory, and public or common resources, land management, amongst others (Vega et al., 2018). In the words of care scholars Cristin Vega Solís and Raquel Gutiérrez "the term of care visualises the racial and gender divisions but also the affective component and the subjective ambiguities in which daily restitution is resolved" (Vega et al., 2018, p. 23). Care, then, is present everywhere: from state services such as social welfare and health, to territories, community care networks, and domestic households (Vega & Gutiérrez, 2014).

Scholars of care in Latin America have questioned the line between the private and the public by placing community life at the centre of their studies. This has evidenced how community experiences denote different care dynamics for women outside urban or Western societies, with, for example, strong reciprocity networks and shared labour. Here, Floriberto Díaz Gomez's concept of *comunalidad* as a way of community organisation, or shared-doing, is fundamental to avoid romanticising community systems as ideal and never changing (2004). As Benjamín Maldonado Alvarado describes, *comunalidad* is a characteristic of communities; it is how life is lived and organised within them (2013, p. 22). This concept allows for a non-essentialising look into communities, where they can be thought of as myriads of relationships between people and environments that are never idyllic or perfect, and which are, as any social form of organisation, subject to contradictions, tensions, and power structures (Gutiérrez & Salazar, 2015; Vega, 2018).

Within this view of community and care, the reproduction/sustenance of bodies and that of territories emerges as a connected entity. If the bodies caring for and sustaining other bodies and territories are subjected to violence (in the case of violence towards women, for example), then whole social and environmental systems are affected – something that is perpetuated under colonial and capitalist structures as they are centred on accumulation, individualism, dispossession, and domination (Gutiérrez, 2017). As such, these scholars call for countering capital-centred politics with a politics of care that recognises the affective materiality that we, as humans, are inescapably subject to (Vega et al., 2018, p. 43). Therefore, they forward systems of care that emphasise the protection of the commons and the collective reproduction of life under a perspective that is *sentipensante* (thinking-feeling*)*,

that is, where reason and feeling exist together rather than as separate faculties (Fals Borda, 2022). Under this view, teachings of feminism from the Global South are not only an intellectual project but also a social one: to take better care of those who do care (Lenguita, 2021).

In this sense, critical decolonial feminisms developed by women intellectuals from *Abya Yala* significantly inform the theoretical and political framework of this work. Specially, its emphasis on centring care, affections, and emotions as inseparable from non-institutional conservation hubs and activities, such as kitchenspaces, public sites, cooking, and community-building. To conserve and to care, in many scenarios, there must be bonds, collectiveness, and value beyond market-based production. Chile can be a matter of flavour, of heritage, of memory, and certainly a genetic resource too. Yet, by making *cocineras'* care practices visible, crop conservation becomes a broader endeavour where amassing resources emerges as one of many other equally valid – and arguably more effective and socially just – strategies.

Methods and Sources

The methods used for chapters 2, 3, and 4 consisted of archival work, mainly material sources from the University of Chapingo, a variety of electronic sources, and oral interviews with Mexican scientists linked to institutions or programmes concerned with chile research and conservation. The methods and sources used in Chapter 5, as will be explained shortly, consisted of participative and collaborative approaches, as well as semi-structured conversations.

Chapter 2 "The Mexican Product" accounts for the first state chile breeding programmes which took place at the National Institute for Agriculture Research (INIA), later the National Institute of Forestry, Agricultural and Livestock Research (INIFAP), in the late 1970s, and which shaped chile's construction as a marketable product and a defined line of research. During the 1970s and 1980s Mexican scientists fought to establish their own research as independent from foreign intervention, even when legacies of the Green Revolution shaped their objectives in creating improved varieties and promoting industrial

agriculture. Chile's dual nature as a basic component of Mexican cuisine and as a commercial product, became an avenue with which Mexican agricultural scientists would build a Mexican science and create a standardised and improved Mexican product. Interestingly, women in this project were framed as consumers of these commodified and new chiles, but not as knowledge producers. In this chapter, I explore this nation building endeavour through a gender perspective by analysing early chile breeding efforts in INIA-INIFAP from the 1970s until the 1990s, when worries on biodiversity and cultural heritage conservation transformed chile research to some extent. This chapter unveils the contradictory forces that shaped science, nation, identity, and imaginaries of loss that still thread and impact state agricultural science, where women's local knowledge remains largely invisible.

During the 1970s and 1980s, but in a different avenue, a group of scientists led a countermovement to the project of rural development forwarded by the state which was in line with industrial agriculture and the underpinnings of the GR. Chapter 3 "The Counter-Revolution" explores the institutionalisation of Mexican ethnobotany and agroecology and the socio-political movement built within these fields; one that pushed against agroindustry, monocrops, and the technification of the countryside. Informed by broader national and international social movements, these scientists called for the valorisation of indigenous and traditional agricultural knowledge as essential elements for a socially just rural development plan. Here, chile was not studied as an individual crop but rather within traditional agricultural systems. Interestingly though, amidst the call for recognising other types of agricultural epistemologies, women were portrayed as secondary actors. That is, peasant men were credited for the diversification, domestication, and conservation of crops, alongside the agricultural expertise related to plant knowledge and food production.

As such, this chapter explores the gendered assumptions that inevitably delineated the counter-revolution that aimed to defend traditional agricultural systems as valuable under a growing capitalist national agriculture. More so, it will argue that the oversight of women's knowledge was threaded to the neglect of chile as an object of study in both fields during the 1970s and 1980s, amongst other reasons such as the focus on agricultural systems rather than on individual crops and the fact that chile is not a grain. Hereof, this chapter contributes to clarifying how ethnobotanists and agroecologists shaped their own research,

which is essential to explaining how and why chile research flourished in these fields until the late 1990s and the 21st century, particularly with reference to gender perspectives and culinary knowledge.

Increasing global concerns around the environmental crisis alongside growing disparities between developed and developing nations during the 1990s led to international mobilisation that materialised in treaties like the Convention on Biological Diversity in 1992 and the FAO Rome summit of 1996. Parallelly, grassroots peasant movements such as the Zapatista Army of National Liberation in Mexico (EZLN) and La Via Campesina internationally in 1996, aimed at countering the massive growth of neoliberal policies that left peasant communities even more vulnerable to market-based economies. Within this context, the development of concepts such as biodiversity, biocultural diversity and biocultural heritage rendered the link between the loss of human cultural traditions and that of biological genetic resources more visible.

Chapter 4 “The Biocultural” elucidates how this connection allowed for chile research to bloom within interdisciplinary studies in the twenty-first century, mainly within agricultural science, ethnobotany, and anthropology. This took place in two spheres: in the National System of Genetic Resources for Food and Agriculture (SINAREFI) inaugurated in 2002 and in Mexican academia. By exploring SINAREFI’s “Network of Chile” and the research propelled by academics within this project and independently, this chapter sheds light into the complex entanglements between international and domestic agendas and their materialisation in conservation strategies and food policy. In this sense, chile’s peculiar characteristics as a culturally basic ingredient, non-grain, local but commodified product, unveils how notions of cultural appropriate foods, biocultural heritage, and local sovereignty were integrated and contested within the state and academia. Drawing on the latter, this chapter offers a historical reflection on the crossings and contradictions of the Mexican state’s definition and implementation of food security and sovereignty policies, apace with those affected and neglected by this logic.

So far, chapters 2, 3, and 4 portray a historical understanding of how chile research unfolded institutionally. Yet as the research unfolded, I noticed there were certain views and narratives that would remain invisible if the project relied entirely on archives, secondary

literature, and interviews with scientists. In particular, I was interested in including the stories and narratives of women beyond scientific structures. This led me to join and collaborate in the research-action project of Cocina Colaboratorio, where I was able to engage with food sovereignty activism and collaborate with women *cocineras* in the community of Santo Domingo Tomaltepec, Oaxaca, Mexico.

As such, the last chapter "The Flavour of Memory" engages on a different, albeit related, journey. My collaboration in Cocina Colaboratorio, whose history and background I detail in this chapter, relied on methods less common in the history of science, such as socially engaged art and participatory action research. This decision emerged from the necessity of telling stories beyond colonial intellectual frameworks, by giving voice to often neglected actors, and as a way of promoting more ethical ways of doing research. Therefore, in this chapter my role transforms from an outsider historian to an active actor in the co-creation of narratives. By creating spaces of mutual recognition and bonding, where more equal conversations can be held, this chapter delineates the different meanings and values that women *cocineras* assign to chile. This, beyond telling the situated story of a single crop, aims at showing how diversity is perpetuated through gendered embodied knowledge like culinary practices, affective links, networks of use, and senses of belonging. In addition, this chapter touches on memory as a vehicle of action and recovery through the example of the chile *tabiche*, a variety that disappeared from the community decades ago. Through uncovering its story in the *cocineras'* narratives and memories, and through collective work, we were able to reintroduce the chile *tabiche* in Santo Domingo Tomaltepec. In this sense, histories on the ground also have the power of enacting change. This, however, was and is not exempt from challenges.

The political standings of this dissertation frame its contributions to academic research beyond theory. Adding to recent efforts in the social sciences, this work seeks to deconstruct one-sided and hegemonic histories by engaging with collaborative methodologies that engage with often ignored *saberes.*[4] Inspired by feminist practitioners

[4] *Saberes* translates as ways of knowing. I will refer to this term throughout the introduction and on Chapter 5 as I believe its meaning in Spanish better reflects the plurality of types of knowledge.

from the Global South, this project is then a wider call to de-construct the prevalent binary logic of academic practice (subject vs. research, objective vs. subjective, reason vs. emotion) into a two-way path that is enacted from empathy, listening, and mutual learning and recognition. Therefore, in addition to demonstrating how and why *cocineras'* knowledge is important for science and policy, this work also seeks to show how women's knowledge matters in its own right, and how it informed my own practice as an interdisciplinary scholar. That is, what I learned (and unlearned) from building chile narratives and stories with them. This is important because in telling a story, value lies not only within the researchers' findings but also in what is taught to them about their practice in the process. With this approach, I hope to further challenge what expertise stands for and who is regarded as an expert to build more equal bridges of collaboration between epistemic communities.

To do so, it is fundamental to position myself within this history in order to signal its limitations. I grew up in Mexico City in an urban upper middle-class family with mixed European and Mexican heritages. As a white woman with access to education, health services, and mobility, I have not been exposed to the oppressions and exclusions of a hierarchical racist and elitist social structure, despite being a woman in a highly patriarchal society. The privileges afforded to me as a white woman have certainly shaped, and limited, my understanding of other womanhoods and their lived experiences. As Federica Gargallo phrases "there, where a privilege exists, a right is denied" (2014, p. 19), and as such, it is necessary to clarify that these privileges limit the ways in which I can fully grasp and narrate other people's experiences. In acknowledging this position, I also underline the continuous responsibility I have in deconstructing my standing, in listening to other voices, and in fighting for the disarticulation of these structural injustices.

Finally, I would like to place myself in the kitchen, and explain why I decided to explore chiles and women's culinary practices as conservation hubs. Whilst growing up, the kitchen emerged as a place of contradictory feelings, as a site of nostalgia but also of inadequacy and constraint. On one hand, my paternal grandmother and great cook, Sylvia, filled my childhood and palate with the most wonderful flavours and memories around food and family. Her

sazón[5] and presence, which varied from Mexican to Italian and everything in between, like her *pozole* or her *arroz con rajas*, still accompany me today, especially when I cook my own version of her plates following my father's teachings. On the other hand, and probably truly so for the rest of the women of the family (including me for a big part of my life), the kitchen was a restrictive space, limiting rather than enjoyable, a place of women subordination. As such, the family kitchens were inhabited and managed by women from poorer backgrounds and from other areas of the city or the country, who worked for many years in my household and that of my grandparents. These clashes made the kitchen a place where I interacted and learned from very different women, all with whom I shared affections and time. Thus, the kitchen emerged as a safe and magic place, but also as a place of division.

As an adult, I have slowly rebuilt and reframed my passion for cooking, something that was sparked by reflecting on kitchens as powerful sanctuaries of encounter, but mainly, inspired to me by the people whom I cooked with during this project. In this sense, my personal history has come to value kitchens and culinary knowledge as a way of connecting to those who nurtured me in the past, but also as a re-appropriation of my identity, of who I chose to be in the present, and of who I want to be in the future. Professionally, exploring the kitchen and the conservation of chile have signified a political and intellectual endeavour to revendicate the role of women and of community-builders as valuable and necessary enhancers of crop diversity and food sovereignty. This work has been cooked alongside a variety of hands and chiles, and as such, I hope that the resulting flavours contribute to threading more voices and practices into the history of science and to envisioning more plural understandings of what conservation is.

[5] *Sazón* is someone's personal flavour or taste when cooking, this concept will be further developed in Chapter 5.

Chapter 2 : The Mexican Product

The webpage of the Mexican Ministry of Agriculture is full of news articles with headlines like *El chile, corazón de la gastronomía mexicana* (Chile, the heart of Mexican gastronomy) (SIAP, 2017). The chile (*Capsicum spp.)* is a source of national pride and cultural identity, as well as an integral component of traditional plates, local cuisines, and Mexican livelihoods. In part, this is due to its staggering diversity, particularly that of landraces – which refer to historic cultivated plants, adapted to local conditions. Many complexities rise from the deep nationalist sentiments towards chile, owed partly to its fundamental role in Mexican cuisine, but also its role as both a domestic vegetable and a profitable export crop. This makes chile an exceptional study case for advancing our understanding of the history of Mexican agriculture and crop conservation. In this chapter, I put forward a historical account of chile research and conservation from the perspective of the Mexican state, particularly from the National Institute of Agriculture Research (INIA), then the National Institute of Forestry, Agriculture and Livestock Research's (INIFAP), breeding and conservation efforts. As such, I account for the background context that enabled the emergence of the INIA's chile breeding programme in the late 1970s and up to the 1990s, when neoliberal policies and its consequences pivoted a transformation of the global discourse on genetic resources.

Therefore, I explore how national genetic resource management and conservation was driven by the state's economic interests and by the advancement of a Western-science framework, despite the underlying state-building intention of constructing an independent Mexican agriculture science. Specifically, my argument contends that chile's dual nature as a basic component of Mexican cuisine and as a commercial product in the domestic and export markets uniquely impacted its study and conservation. In this sense, I inquire how *agrónomos'* link to chile's symbolism as a marker of Mexican identity and nation greatly

shaped early chile breeding programmes. Very importantly, I show how these scientific programmes framed women in their work, which adds to questioning how women were considered, or not, in Mexican agriculture science.

The chapter is organised as follows. The first section sketches the origins of chile research in the Mexican Agriculture Programme (MAP) and in the newly created INIA[1] between the 1940s and 1970s, addressing the original incentives and intended implications of chile research as targeting a commodifiable vegetable or *hortaliza*. Here, I argue that the characteristics of commercial chile were initially moulded to domestic market requirements under the influence of an established MAP framework. In the second section, I explore the creation of INIA's Chile Programme, particularly, the shift to a genetic resource-focused agenda from 1978 to 1994. Chile studies during this period expanded considerably, as did conservation efforts in line with international concerns for genetic resource loss. In parallel, I describe the search for independent national scientific infrastructure and how this became interlaced with chile as a symbol of 'Mexicanness' in chile researchers' imaginaries. Here, women were considered the main chile "buyers" as housewives. As such, I will discuss this gendered role and its implications. In the third section, I analyse changes introduced by NAFTA in 1994, fuelling a series of seismic shifts in Mexican Agriculture which re-shuffled chile breeding, production, and commercialisation. During this period, the vegetable or *hortaliza* sector underwent drastic changes as the export market began to dominate, negating moves towards national food self-sufficiency.

Despite the existence of several chile research and conservation bodies in Mexico, the main sources I use to construct this account are INIFAP's publications and reports, as it was the most representative and influential institution for plant breeding and seed conservation in Mexico for much of the period discussed here.

Mexican Agriculture Research, Nation Building, and Chile

[1] INIA changed to INIFAP in 1985 as the Institute of Forestry and the Institute of Livestock were merged with INIA.

As part of the Ministry of Agriculture, throughout its history, INIA, then INIFAP, has aimed to increase agricultural production in rural Mexico by developing new varieties of crops as well as technological packages which have generally entailed the use of fertilisers, pesticides, or irrigation systems. In 2024, INIFAP numbers 8 regional research centres with 38 experimental stations and 5 national research centres, scattered throughout the country. The INIA/INIFAP was a continuation of the "Mexican Agriculture Programme" (MAP), a collaboration between the Rockefeller Foundation and the Mexican government between 1943 and 1961 that aimed to modernise national agriculture through the development of new staple crop varieties, mainly corn and wheat. This programme, overseen by the Office of Special Studies (OEE), is claimed to have led to the pioneering movement referred to as the Green Revolution (Cotter, 1994).

The influence of a Green Revolution-like ideology on Mexican agricultural development and its subsequent relation to liberalisation of markets and trading treaties has been explored and debated extensively from the 1970s (see Curry, 2021, 2023; Hewitt de Alcántara, 1976; Feder, 1975; Fitzgerald, 1986; Gutiérrez, 2017; Jennings, 1986; Lorek, 2022, 2023). Particularly informative for this chapter is the work of Joseph Cotter, as he provides an exhaustive study on the professionalisation of Mexican *agrónomos* or agricultural scientists during the 20th century. Cotter argues for the historical role of *agrónomos* as mediators between foreign science and the construction of a national agricultural research (2003). As such, he details the socio-political struggles between Mexican research institutions, the state, and *agrónomos,* where the pursuit of agendas was motivated primarily by economic incentives. This, alongside other accounts of agro-industrial development in Mexico such as those mentioned above, has set the ground to understand the marginalisation of local peoples' knowledge and practices, the widened socio-environmental inequalities, and the advancement of agro-industrial production in 20th century Mexico.

Two other bodies of scholarship on agricultural research and production in Mexico are of fundamental relevance to this chapter. These address distinct but entwined histories of staple crop and export crop production. For the former, maize-related studies have framed the discussion around 20th century Mexican agricultural policies, standardisation of biotypes, incentives, and debates around crop genetic resource conservation, breeding, and production

(Gutiérrez, 2017; Fitting, 2011; Fox and Haight, 2010). Scholars in this field have shown how the establishment of free trade treaties and market liberalisation affected the capacity of smallholders and peasants to make a living from maize production, causing migration and rural displacement. More so, they have discussed how the erosion of maize landrace varieties emerged under an industrial-agriculture regime which increasingly favoured the production of export crops for economic gain and neglected subsistence agriculture.

On the other hand, researchers have also explored the history of Mexico's export crop production and commercialisation, particularly how technologies and policies linked to the modernisation of agriculture and the growing focus on economically viable export crops accentuated social disparities, stimulated internal and transnational migration, and furthered environmental degradation (González, 2014, 2019; Knight, 2000; Suárez, 1982; Wright, 2005).

The history of genetic conservation is inexorably linked to this discussion. Within this paradigm, Curry (2017b) charts the seed collection efforts undertaken by the Rockefeller Foundation in Mexico during the Mexican Agriculture Programme (1943-1961) in response to growing concerns around loss of crop diversity, ultimately positioning this institution as a global leader in plant genetic resource conservation. Curry's work delineates the history of seed banks as agricultural technologies and how they were internationally adopted as the main conservation strategy for plant genetic resources from the 1970s onwards (2017a). On the other hand, Fenzi & Bonneuil (2016) offer an account of the changing perspectives on crop diversity loss in the international arena particularly within institutions such as the United Nations (UN) and the Food and Agriculture Organization (FAO) during the twentieth century. These authors track the evolving *resourcist* view in conservation policies, which they define as the conceptualisation of genetic resources as economically exploitable material. According to them, this *resourcist* view persisted even in the more re-valorisations of farmers' knowledge and *in situ* conservation in 1990s global conservation discourse, as will be discussed further on.

In conversation with these authors, in this chapter I add to this literature by exploring how chile research from the 1970s to the early twenty-first century was governed by specific agricultural incentives and motivations linked to its symbolism of Mexicanness, its cultural significance, and its agricultural classification. As chile pertains to the crop group of vegetables

or *hortalizas*, its breeding was shaped by pressures specific to this group of products, such as the pursuit of uniformity in shape, colour, smell, and flavour. This contrasted with the existing pressures on staples, which are crops that dominate diets due to their high energy and nutrient content, such as grains, and where aesthetics and freshness were and are not a baseline for effective commercialisation. Moreover, chile's link to Mexicanness and its grouping as a *hortaliza,* revealed gendered visions of crop production and commercialisation – as women were imagined as decision-makers on the vegetable's consumption but not as knowledge carriers or producers. Therefore, this chapter contributes to thinking about historical processes in agricultural science from the standpoint of nation building, the differences between agricultural crop groups, and gendered conceptions of crop-human relations.

Crop groups – such as cereals, vegetables, herbs, fruits, oil seeds – have been typically constructed around agricultural characteristics and experience-based classifications that account for similarities in structure, shape, growing season, cultural practices, utilisation, yield, amongst others (Harlan & de Wet, 1971), rather than fixed on formal taxonomic classification (Hetterscheid & van der Berg, 2008). During and after the Green Revolution, when crop standardisation and global agricultural exchange skyrocketed, crop groups acquired a more international and transnational delineation. Examples of this internationalisation include FAO's crop concepts, definitions, and classifications, ongoing from the 1960s through its Statistics Division (FAO, n.d). Also, the Inter-Regional Research Project Number 4 (IR-4), inaugurated in 1963 by the US Department of Agriculture, which emphasised crop grouping as vital for assisting farmers with pesticide use and residues (2022).

In line with the international institutionalisation of crop groups, which signalled the social, economic, and commercial qualities of crops, INIA/INIFAP's crop groups have generally included staple crops, fruits, oilseeds, and vegetables or *hortalizas*. The latter group has included crops like tomato, squash, cucumber and of course, chile. As such, these agricultural crop groups can slightly vary from place to place but are nevertheless informed by globally generalised economic interests and production goals. In this sense, *hortalizas* – more than any other crop category in Mexican food policy – have been oriented towards a business and intensive agriculture model as their economic viability is derived from solid domestic urban

demands and, increasingly, from international markets. This contrasts with many local rural and urban settings where chile landraces and local varieties are still the preferred option for both production and consumption – guided by situated cultural preferences rather than on commodity aesthetics.

In Mexican agricultural policy, chile's commercial focus fostered specific profit-based research and conservation strategies shaped largely by economic incentives, mostly in northern irrigated Mexican states. Therefore, in this chapter I argue that analysing chile as a commodifiable *hortaliza* provides deeper insights into the type of concerns that have motivated scientists to conserve or research certain crops. Further to this, I describe how the essentialisation and romanticisation of Mexican cuisine positioned chile as an icon of independence for INIFAP researchers; a symbol that their research mattered and had a particular place in Mexican Agricultural science. Despite the efforts to build an independent and national scientific structure, however, contradictions surged as Western scientific aspirations and economic motivations remained the guiding avenue of the Mexican state and of INIFAP's *agrónomos*.

This context unveils another fundamental aspect of this dissertation: *agrónomos'* take on women in connection to the chile crop. In line with the period's binary and patriarchal Western scientific ideals, these early chile research and conservation efforts touched on the role of women in relation to chile's commercialisation in a very specific way: as housewives, and thus the main buyers of chiles in markets and supermarkets. Urban and middle-class women, assumed in charge of cooking and buying ingredients for house maintenance activities, were the target of this standardised Mexican chile. Indigenous women, on the other side, were not framed as neither buyers or producers. This interestingly expands our understanding of how colonising ideologies of gender and class have entered, in specific ways, scientists' work on crop conservation.

More so, the case of chile is particularly exceptional: unlike many other *hortalizas* and export crops, its link to traditional Mexican cuisine has arguably made this crop a *basic* one — perhaps not in terms of food insecurity but as a key component of Mexican diet (Gálvez, 2018; Peña et al., 2017; Pilcher, 2001). This dual nature of chile, being both a subsistence component of Mexican diet and a commodified domestic and export crop, situated this plant

in a peculiar space with reference to food security because it shows the underlying institutional interests in relation to the use of this concept during this period. As some scholars have noted, the "calorisation" of food post-World War II has been influenced by neoliberal policy, particularly from the 1980s, whereas nutrition, cultural preference, and human health have been neglected in food policy (Appendini, 2001; Appendini & Liverman, 1994; Carolan, 2013; Gálvez, 2018; Grisa et al., 2021). In Mexico and much of the Global South, this approach to food security and policy took place in tandem with the prioritisation of industrial agriculture, the importation of grains, and the exportation of vegetables and fruits.

The Ministry of Agriculture in Mexico has generally aligned to FAO terminology for building reports and documents (INIFAP, 1996; Ramírez et al., 2000). As such, here I define food security as the attainment of sufficient *caloric* intake for the population. This definition remained in state-led plant diversity reports until 2002, when a change in discourse happened in line with international debates calling for the expansion of the term.[2] As this chapter is situated in the period from the 1970s to the late 1990s, here I analyse the ways in which institutional sectors of agricultural research in Mexico have integrated and applied early concepts of food security and how this related to chile research and conservation. Particularly, I explore how chile as a *hortaliza* exhibited characteristics that did not fit into typical food security concerns by that time, but that mattered for food security because of its roles in Mexican culture and cuisine. More broadly, this highlights how characteristics such as cultural and dietary relevance were addressed at an institutional level before the emergence of more encompassing concepts such as food sovereignty or food justice.

Therefore, my argument derives in three main lines of thought that do not necessarily correspond to the chapter's structure established above. First, I follow chile's categorisation as a commodifiable vegetable and the changing economic incentives that shaped its research and conservation. Here, I am particularly interested in reflecting on how urban women were framed as the target of standardised chiles, unveiling the gendered, racial, and class ideas

[2] For example, with social movements such as La Via Campesina, which proposed the concept of food sovereignty as an expanded term that integrates a re-valorisation of culturally linked foods and the rights of people to produce it themselves using agricultural practices of their choosing (1996).

that filtered in Mexican scientific thought. Second, I chart the ways in which chile's dual nature as basic for the Mexican diet, and as a commercial product, intersected with growing concerns on food security. I juxtapose the term *basic* – generally used for staple crops or grains – in Mexican cuisine to offer a way to include chile beyond a standard classification of what is necessary to survive to what is necessary in *cultural terms*. Third, I put forward an account of how subjective factors, such as the romanticisation of chile in Mexican cuisine, shaped INIFAP researchers' imaginaries and ultimately their own research. Therefore, I will add to the understanding of historical state-led Mexican agriculture and crop conservation by charting how researchers studied and conserved chile as an important commercial *hortaliza* – one that was bred for a specific group of women – whilst also recognising the symbolic Mexicanness of the crop, which shaped their identities as Mexican scientists.

Background Context of Chile Research and Breeding 1940s-1970s

The Mexican government's focus on agricultural development, and on the collection and conservation of certain plants, has generally been directed at increasing the production of grains such as maize, wheat, and, to a lesser extent, beans. As such, the first germplasm of INIA-INIFAP – then the Agriculture Research Institute (IIA) – was created in 1944 with 2000 collections of maize and 3000 collections of beans (Reveles-Torres & Velásquez-Valle, 2017). This was implemented within the MAP at the OEE, where the collection, evaluation and improvement of crop varieties was undertaken to accelerate dramatic changes in production; these were the precedents for the Green Revolution.

In the wake of 1930s *Cardenista* pro-peasant agricultural frameworks,[3] the period between the 1940s and the 1960s saw the birth of an institutional Mexican framework that was oriented towards a commercial and capitalist agricultural model (Suárez, 1982, p. 69). On the one hand, the state prioritised research and collection of grains to secure the country's

[3] President Lázaro Cárdenas (1934-1940) was famous for implementing an "*agrarista*" or pro-peasant agricultural reforms. For example, he created the ejidos, or communal lands, and favoured the Revolutionary ideal of land repartition.

basic caloric intake, with the goal of sustaining grain self-sufficiency. This was a difficult endeavour considering the global economy of grains, where competition drove the prices down. On the other hand, vegetables or *hortalizas* emerged as profitable commodities. Since the state-led agricultural production strategy for both grains and *hortalizas* involved large scale farming in irrigated areas, small and medium producers were significantly neglected. This resulted in a contrasting agricultural landscape.

Under this context, the collection and breeding of potentially economically valuable crops, such as chile, became part of Mexican agricultural research. Even if they were studied to a lesser extent than staple crops, these early efforts to produce commercially valuable crops became the steppingstone for what in later decades would mean a huge reorientation towards the exportation of commercially valuable crops on the one hand and the importation of staple and basic crops on the other (Appendini, 2009). In this section, I will develop an account of early chile research, particularly of the ways in which the agricultural crop group of *hortalizas* shaped the study, improvement, and conservation of chile under a period of institutional instability.

Research on tropical fruits and vegetables was first implemented between the MAP and the Mexican Ministry of Agriculture. Early research on chile breeding and collection took place at IIA's Pabellón Agricultural Station, in Aguascalientes, and was one of the Ministry of Agriculture's first plant-breeding successes during the period of 1944-1946 (Cotter 2003, p. 193). Subsequently, in 1952 an early chile genetic improvement project was created within the OEE, where native varieties of chile *ancho, mulato, pasilla* and *jalapeño* types were collected for genetic improvement. This programme aimed at enhancing major Mexican chile types for expanding the national market. In 1956, these seed collections were passed on to the "Programme of *Hortalizas*" at the recently inaugurated Horno Agricultural Experimental Station in the State of Mexico. After this, they were transferred to the newly created INIA: a union between the IIA and the OEE that took place in 1961. These chile collections were re-distributed to several INIA research centres based on local economic relevance (Pozo, 1981, p. 3-4). INIA's research, then, was concentrated in more prosperous and rich agricultural regions, obviating the needs and requirements of more marginalised and impoverished peasants, who were – and still are – a majority in the agricultural sector (Cotter, 2003). This

continued the MAP legacy of prior years and fostered a Western-like agricultural science based on “modernisation” and “progress” (Suárez, 1982).

The formation of INIA caused several changes in Mexican agricultural research. Representing the unification of two contrasting institutes, IIA and OEE – the former, a state-led science institution and the latter a foreign-led one – resulted in the consolidation of an established national agricultural research structure. Therefore, INIA entailed a solid professionalisation of Mexican *agrónomos* (Cotter, 2003), as they supplanted foreign scientists as authorities in Mexican agriculture. However, the influence of the Rockefeller Foundation persisted in Mexican agricultural science through on-going collaborations, caused largely by the foundation of the International Corn and Wheat Improvement Centre (CIMMYT) a few years later, and the continued presence of many OEE researchers in the newly inaugurated INIA.

Moreover, the foundation of INIA was accompanied by a reorganisation of the national seed industry. With the newly published Law on the Production, Certification, and Commerce of Seeds, the National Seed System was established. It encompassed INIA as the centre of research for plant breeding, the National Seed Producer (PRONASE) as the public producer and distributor of seeds, and the National Seed Inspection and Certification Service (SNICS) as the official institution for the qualification and certification of seeds (Suárez, 1982). This led to a state monopoly concerning the production of new crop varieties, their production, distribution, and the commercialization of seeds in the country.

INIA’s objectives were to twofold: to produce improved seed varieties that would prompt the increase of agroindustry production and to also offer affordable alternatives for small and peasant producers. Yet, INIA’s plans also included the “best use” of natural resources and the conservation of exemplars in the germplasm bank (Suárez, 1982, p. 73). From 1961 until 1978, INIA undertook a diversification of crops for research and improvement, with chile receiving considerable attention secondary to the priorisation of grains. INIA produced new chile varieties in this period, specifically of *chile ancho* in 1962, 1963 and 1964 (varieties *Esmeralda, Verdeño* and *Flor de Pabellón*), *chile guajillo* in 1974, *chile pasilla* in 1962, and *chile serrano* in 1969 and 1974 (Ortega Pazcka, 1976). Also, varieties of *chile mulato* and *jalapeño* were developed (Muñoz & Pinto, 1966). These chile varieties were

(and still are) commercially valuable and are mainly produced in the Central and Northern regions of the country, where land irrigation is predominant and where medium-to-large scale agriculture is abundant. Moreover, the production and commercialization of chile seeds expanded through PRONASE, which produced and distributed seeds of thirty new chile varieties, developed by INIA research centres between 1968 and 1980 (Suárez, 1982, p.79).

INIA's chile research efforts in the 1960s also encompassed chile geographic distribution studies, which denoted the crop's relevance to *agrónomos* and to the Mexican economy more generally. As early chile INIA researchers Muñoz and Pinto claimed in their brochure "Geography of the Cultivated Chiles in Mexico", "from an economical point of view, *C. annum* is the most important species in Mexico and maybe in the whole word" (1966, p. 9). Specifically, they remarked that this economic importance was caused by chile's starring role in Mexican diet:

> "Chili is one of the most important horticultural crops in Mexico, because here it is consumed in greater quantity than in any other country because it intervenes in the daily diet of the people in different ways, either as green chili, dry chili, chili in powder, canned chili peppers, as a condiment in the form of sauces, as a main dish in the case of stuffed peppers, and in many other forms. Either way, hot peppers are preferred over so-called sweet ones" (Muñoz & Pinto, 1966, p. 3).[4]

From this passage, two things stand out. First, it is important to note that, at this point, chile's economic relevance as a *hortaliza* encompassed mainly the Mexican national market. Chile was already a central part of every-day Mexican cuisine and life, in all regions of the country, trespassing social class and ethnicity, which related it to a nation-building and identity discourse (Laborde & Pozo, 1982; Long-Solís, 1998). Chiles were produced and sold, and still are, across the country, from the biggest urban centres to the most remote village. Indeed, chile was not the main caloric intake of Mexicans, but it offered an important source of nutrients and above all, of flavour.

[4] All translations are my own.

This takes me to the second point, which is that chile did not receive attention as a crop essential to establishing what later came to be designated as 'food security' in Mexico, as it is not a particularly caloric crop (Fuente Hernández et al., 1990). Yet, its importance in terms of cuisine did position chile as a basic component of the Mexican diet in cultural terms. As I will develop throughout the chapter, the intersection between chile's place in the market and chile's link to Mexican diet provides an interesting point: while chile was *not* part of the food security concerns of later periods, it was considered a basic component for national culinary culture, diet, and for the economy. Therefore, chile's culinary, cultural, and economic importance led to other types of high-priority research in relation to domestic demand and in identifying species diversity.

It was for these domestic reasons that early chile research at INIA aimed for more productive, marketable chile varieties; essentially, a commercial chile with uniform characteristics. That is, a homogeneous, aesthetically attractive chile, that would be easily acquired by anyone in big markets or supermarkets, and that complied with certain regulatory and quality standards. This touches on the general search for aesthetic constancy in *hortalizas*, something that rendered them fundamentally different than, for example, grains. Moreover, this contrasted with the chile varieties produced in the *milpa* (Mesoamerican subsistence crop-growing system), forest, or local garden which often had irregularities in size, shape, colour, and flavour, but which nevertheless accounted for most of Mexico's rich culinary diversity.

These two chiles – "the commercial" and the native, or diverse "local" – were situated in different socio-economic spaces; one embedded in an economic-driven commercial space and the other in a small-scale, subsistence and local one. In a way, INIA's researchers served as a joining point for both, as chile breeders collected and conserved the latter to develop the former. This, of course, was not particular to chile; other crops were also conserved and improved. However, the uniqueness of chile resided, under the broader standardisation of *hortalizas*, in the cultural connection it implied for researchers.

Coming back to chile production, the export market also grew during this period, albeit at a slower pace. Some seed varieties were introduced from the United States by the private sector for their exportation back to the US (Muñoz & Pinto, 1966; Suárez, 1982). These chiles

were mainly sweet varieties, such as anaheim and bell peppers, not consumed nationally in Mexico but well-liked in the US (Muñoz & Pinto, 1966). In other words, Mexico became a chile provider for the US, and the US became a chile seed provider for Mexico long before the liberalisation of markets in the 1980s and 1990s. Therefore, it is in this early period that the separation between the domestic and export production began. Chiles grown for domestic consumption were predominantly INIA's varieties and local landraces, and predominantly spicier, while the export market used mostly American seeds and produced sweeter varieties.

Despite INIA's interest in and need for domestic chile development, maintaining collections of native chile as resources for breeding was not a high priority. When the OEE and the IIA merged in 1961, the OEE's seed collections became part of INIA's patrimony (Taba, 1994). However, literature suggests that until 1978, all INIA seed collections were widely abandoned and that there was a lack of policy towards the evaluation and conservation of genetic resources (Cervantes, 1978; Suárez, 1982). Even if one would suppose that the collections might have been used or expanded due to INIA's diversification of crops and the development of new varieties, the focus of research remained limited to genetic improvement of existing seeds (Méndez Ramírez, 1990, p. II). It is hard to truly ascertain the exact seed policy and experience over this period, as the chile-specific literature is scarce. However, later accounts document several problems within INIA in these years, such as conflicts between internal research groups, the loss of experienced staff, lack of resources and budget, the implementation of policies that favoured middle scale producers and the private sector, a rigid bureaucracy in budget management, and the reduction of support and links with other national and international institutions (Fuente Hernández et al., 1990, p. 27).

Moreover, the Mexican political panorama of the 1960s and 1970s was one of great instability and socio-political turmoil. The student and university movement in 1968, followed by the Tlatelolco Massacre, evidenced the profound socio-economic inequalities of the so-called "Mexican Miracle": a period of economic growth due to capitalist policies between the period of 1940s-early 1970s. As a response, the government of Luis Ernesto Echeverría sought to appease the population's rage with a series of nationalist *Cardenista* left-like policies and the resurgence of *agrarismo*. These policies encompassed the establishment of several public

institutions, such as the inauguration of the National Council for Science and Technology (CONACYT) in support of national research and education.

Moreover, rural assistance projects were created to tackle the contrasting socio-economic realities of large-scale farmers on the one hand and peasants and indigenous communities on the other. Through this, Echeverría implemented new land repartition (or *ejidos*), guaranteed crop prices, and highlighted the importance of food security (Cotter, 2003, p. 282). Food subsidies were implemented through the already existing National Company of Popular Subsistence (CONASUPO). New agricultural programmes such as "Plan de Chapingo" and "Plan de Puebla" focused on attaining self-sufficiency with the production of basic and staple crops, mainly that of maize (Fuente Hernández et al., 1990, p. 35).

Despite the emphasis on staple crop self-sufficiency, the economic crisis forced the importation of basic crops from 1971 to 1975 (Fuente Hernández et al., 1990, p. 45). The failed promise of subsistence crop autonomy led to an obligatory boost on the industrialised production of *hortalizas* and fruits for both domestic and export crop markets in the following years, which caused subsequent administrations to depart from *agrarismo* ideals. While fruits and *hortalizas* were excluded from state-led self-sufficiency programmes, they became increasingly vital for Mexican agriculture in terms of balancing the economy, which placed a heavy emphasis on the importation of grain crops, especially maize.

In this sense, during the 1960s and early 1970s chile research was undeniably influenced by the agricultural group to which it belonged, that of *hortalizas.* This category produced incentives and disincentives for collecting, studying, conserving, and improving chiles. For one, *hortaliza* production required specific aesthetic and industrial qualities, directed towards the standardisation of types. Moreover, *hortalizas* differed from staple crops as they had a stable domestic market, and thus delivered economic profit and security. Particular of chile, however, was its pivotal role in Mexican diets and its cultural symbolism, which solidified in *agrónomos'* discourse in INIA's newly inaugurated Chile Programme in 1978.

INIA's Chile Breeding Programme and Genetic Resources Conservation

During the 1970s and 1980s, generalised discontent with the consequences of the Green Revolution and the loss of plant genetic resources permeated the international arena. Locally, such concerns over genetic erosion and the state of genetic resources developed through all sectors of agricultural science, albeit addressed from varying standpoints. On one hand, relevant characters in Mexican agricultural science such as Efraím Hernández Xolocotzi and Arturo Gómez-Pompa advocated the study of local and indigenous knowledge as essential for the development of adequate agricultural systems for small-scale and subsistence producers and communities, as well as for environmental preservation and the continuation of cultural traditions (Astier et al., 2015). This developed into the field of Mexican ethnobotany and agroecology (Altieri 1999), as will be explored in the following chapter. *Agrónomos* at INIA, however, continued to support a progress-oriented and technological focus for agriculture, which related more to the legacy of the MAP.[5] Although taking different approaches, both groups converged in the construction of a national scientific research agenda, as part of an emancipation effort from foreign dominance in agricultural science, particularly from that of the US (Cotter, 2003). With this as context, in this section I will outline the creation of INIA's Genetic Resources Unit and its own Chile Programme, which entailed significant changes for chile research and conservation from 1978 onwards.

In line with the above, both *agrónomos* and ethnobotanists called for wide-ranging studies on the state of plant genetic resources in Mexico. More so, many stressed the necessity of an official programme for plant genetic resource conservation and the curation of seed collections, which were practically non-existent. These demands materialised in the meeting "Analysis of the Available Genetic Resources in México" held by the Mexican Society of Plant Genetics in 1978, where key figures in agricultural research, such as Efraím Hernández Xolocotzi (Postgraduate College or COLPOS), Francisco Cárdenas Ramos (Genetic Resources National Coordinator), and Rafael Ortega Paczka (Head of the Maize Germplasm Bank at INIA)

[5] This division is not black and white. As will be explored further on, ethnobotanists claimed and defended the need of integrating their work with that of plant breeders at other institutions. Although collaboration happened, a proper coordination between institutions and fields remained an area of conflict during the following decades until the 21st century (Cervantes, 1978; Molina & Córdova, 2006).

discussed pertinent issues spanning plant genetic resources, the existing research on different crops, and the potential future use of these (Cervantes, 1978).

Drawing on these discussions, INIA inaugurated the "Genetic Resources Unit" in 1978, which would attempt to organise, re-evaluate, and expand different seed collections inherited by the Rockefeller Foundation (Reveles-Torres & Velásquez-Valle, 2017, p. 7). This task force allocated research teams for each priority crop with the purpose of "achieving practical results based on the real needs" of farmers, who were the actual practitioners of agriculture (Álvarez Luna, 1980, p. 25-26). However, the overall objective of INIA remained mostly aligned to that of its inauguration in the 1960s. As INIA's director Eduardo Álvarez Luna stated in 1980, this objective was defined as:

> "…the generation of the necessary technologies to increase productivity and agricultural production in Mexico, preferably considering the interests, requirements and socioeconomic conditions of the producers and the consumers, in such a way that the increases ... satisfy not only the food and nutritional needs of the Mexican population, in constant growth, but also supply the industry and produce the necessary volumes to serve our export markets, all this, always seeking the well-being of the producers and the population in general" (1980, p. 12).

In other words, INIA would still aim to modernise production and enhance industrial agriculture. As such, INIA established independent research groups for economic crops that had originated or diversified in Mexico. Indeed, the priority of these programmes was the generation of technologies to increase agricultural productivity and thus economic gain (Laborde & Pozo, 1982, p. 24). Under this institutional framework, researchers viewed Mexico's crop diversity as a potential exploitable resource (Fenzi & Bonneuil, 2016) and as a matter of national wealth that implied cultural and economic advantages.

It is under this context that the Programme for Chile Research at INIA's Genetic Resource Programme was inaugurated. Here, chile research concentrated on obtaining new chile varieties with high yielding potential, good fruit quality, and a wide range of adaptation.

National efforts also encompassed studies on chile diseases. Meanwhile, the expansion of the chile germplasm collection would see researchers characterise and conserve the genetic variability in the country for later use in genetic improvement programmes.

Chile Programme: Cuisine, diversity, identity, and chile as a product

The Chile Programme's headquarters were set in the Experimental station of Las Huastecas in Tamaulipas, Northeast of the country, and one of the most important chile producing regions. However, it was orchestrated across different INIA Research Centres throughout Mexico in accordance with regional production of various chile types. The main incentive for this division was economic. Indeed, the varieties of chile that were studied, improved, and harvested were predominantly those which held commercial value: namely chile *ancho, serrano, mirasol* and jalapeño, approximately totalling 75% of the cultivated area. To contextualise, chile was an already well-established crop in terms of production, with about 80 thousand hectares of cultivated land in the early 1980s (Laborde & Pozo, 1982, p. 18). INIA's main chile projects were divided between the Campo Experimental Agrícola Bajío in Guanajuato for *ancho* and *mulato* chiles, Campo Pabellón in Aguascalientes for *pasilla* and *guajillo*, Campo Huastecas (Headquarters) for chile *serrano*, Campo Cotaxtla in Veracruz for *jalapeño*, Campo Zona Henequera in Yucatán for chile *habanero* and Campo Santiago Ixcuintla in Nayarit for chile *de árbol* and *cora* (Pozo, 1981, p. 4). With the inauguration of the Genetic Resources Unit, INIA saw fit to regionalise research, so that technologies would be created *in situ* and thus be appropriate for the "agroecological conditions" of each productive region of the country (Álvarez Luna, 1980, p. 17).

INIA's chile research, however, remained directed towards the domestic urban market. During these years, the demarcation between national and export production was still clear. Even when a growing private initiative began to thrive in the fruit and *hortaliza* sectors, the state's monopoly over the creation of new varieties for domestic consumption continued to dominate the chile market (Suárez, 1982). Out of all fresh chile production, only 10% was directed for exportation (Laborde & Pozo, 1982, p. 22). Even so, Mexico was by then one of the main chile providers for the US and Canada, particularly for the winter season.

These chiles were cultivated with American seeds imported by the private sector and grown in very specific prosperous and irrigated areas in the North such as Sonora and Sinaloa. Moreover, they were American varieties, mainly bell peppers (80%) and mildly spicy chiles like anaheim, caribe, red peppers, and fresno. These were neither distributed nor consumed nationally.

As a profitable crop with a strong and stable domestic market, increasing production was a focal incentive for the Chile Programme, enacted mainly through the development of technologies ranging from the creation of disease-resistant varieties to novel drying techniques. These technologies, though, were unevenly distributed in Mexican territory. As chile researchers Laborde and Pozo remarked of chile conservation in 1982 "very contrasting technological differences are observed; from the highly technical and sophisticated ones of the Sinaloa and Sonora regions to the rudimentary or traditional technology of some regions of Veracruz, La Huasteca Hidalguense, and the Yucatan Peninsula, where the adoption of new technology is slow due to the low cultural level and the scarce economic resources of the producers. There is a need to find the best alternative for each region" (1982, p. 23). Both Laborde and Pozo were researchers at the INIA Genetic Resources Unit and trained as agricultural scientists. The former worked as Head of INIA's Internal Planning and Evaluation Commission while the latter served as the National Coordinator of the Chile Programme from its origins until 2007. Even if both published prolifically on chile, Pozo's legacy was particularly influential in national research, as he directed the Chile Programme for almost thirty years (Moisés Ramírez Meraz, personal communication, 2021).

These researchers casted "adopting new technology" as an obvious step, a position very much in line with a modernising, Green Revolution view. Yet, they also recognised the different needs of each region, and the adaptability of technology to each part of the country. In terms of the varieties being cultivated, this differential representation of technological advancement mapped new commercial varieties in more industrialised regions and landraces in poorer or marginalised areas. Meanwhile, Laborde and Pozo's view of some practices as "rudimentary" or the lack of technological adoption as caused by "low cultural level", call attention to the uneven validity of knowledge between *agrónomos* and campesinos, where

agricultural science was set as a higher epistemological standard to find "the best alternative(s)" for crop production (Cotter, 2003).

That said, it is important to note that the discourse surrounding chile research was not only one of modernisation and efficiency. Chile breeders like Laborde and Pozo also reflected on the history of chile, and the association of its diversity with a rich cultural diversity in Mexican cuisines, as a key justification for their work. Laborde and Pozo explain on their INIA book of chile diversity and agriculture that each chile has "a specific use in some of the many facets of Mexican dishes; hence the explanation of the diversity of chile types" (1982, p. 7). Chile is presented as an essential part of Mexican nutrition along with maize and beans, but from a very specific angle: "from these crops [maize, beans, chile, and courgettes] the only one that plays a different role, providing vitamins and minerals, and having been selected for its contribution to the diet as condiment, is chile (*Capsicum annum*)" (1982, p. 7). Moreover, chile, as a mainstay of Mexican cuisine, became symbolic within a nation building discourse of the time: "It is true that in Mexico it is used mainly for its spice, but the crop represents a range of uses, flavours, combinations that are reflected in a cultural constant of Mexico, which makes it a synonym to Mexican nationality" (1982, p. 7). These assertions became a part of and shaped the scientists' research agendas and aims, and as I will further discuss, the conservation of chile genetic resources.

Interestingly, the idea of chile diversity as a source of national pride, linked to millenary culinary practices, was not perceived by INIA researchers to conflict with the development of new and improved varieties – not even when such varieties were causal in the genetic erosion of native chiles central to the cuisine they proclaimed to be proud of. In line with the resourcist view of plant genetic resources in the international arena (Fenzi & Bonneuil, 2016), during this period the value of landraces was attributed to their use as raw material through which plant breeders could create better and more productive chiles. INIA research conceptualised local landraces as detrimental to production, at least for chile commercialization, since "native cultivars used in commercial spicy chiles are low-yielding and of poor quality due to the mixture of subtypes, morphological variation, and diversity of fruit forms, which detracts from the commercial and industrial acceptance of the product. In addition, they are susceptible to the main diseases and pests" (Laborde & Pozo, 1982, p. 23).

In this sense, improved varieties were considered an obvious step towards efficient and successful chile production since their uniform size, shape, colour, texture, and flavour gave these significant advantages over local varieties in the market (Laborde & Pozo, 1982, p. 39).

By 1982, INIA had produced a total of 22 improved chile varieties from the seven main commercial chile types. Several of these had been received with success by farmers, mainly the serrano-types *Tampiqueño-74, Altamira,* and *Pánuco*, which according to Laborde and Pozo, were cultivated in a significant part of the country (1982, p. 25). Also, they remarked on the success of chile *ancho* types *Esmeralda* (Figure 2.1) and *Verdeño*, which were developed in the 1960s and still in use by the 1980s (Pozo, 1981). Concerning chile types that had not yet been improved, researchers assumed they too would eventually be replaced by INIA's varieties. For example, they explained that in the case of the *costeño, cora,* and *chile de árbol*, whose production still depended on native varieties and were thus "heterogenous" in form, shape and flavour, replacement with improved varieties was eventually inevitable. Laborde and Pozo argued, "Experience tells us that, as with the serrano chile, when *Tampiqueño-74* was distributed, as soon as a variety with uniform plants is obtained, it will displace in a few years all the native types" (1982, p. 53) (Figure 2.2). These new chiles, however, would not lose their Mexicanness but quite the opposite.

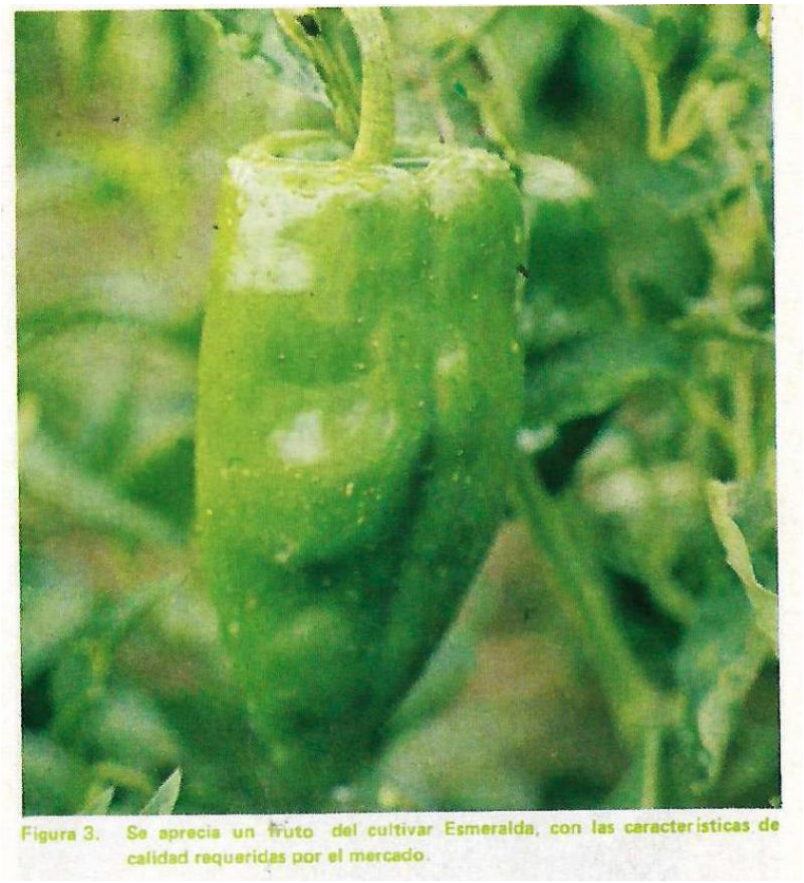

Figure 2.1 *A fruit of the Esmeralda variety with the required quality characteristics for the market (Pozo, 1981, p. 9).*

This "natural" step towards improved varieties did not contradict national pride in chile diversity because these varieties were envisioned by chile researchers to be just as Mexican as the landraces which preceded them. In a period where an urgency to build a scientific and technological infrastructure permeated Mexican academia and politics, chile – portrayed as an *authentic* Mexican crop – embodied INIA researchers' emancipation from US leadership in agricultural research and modernisation. This, of course, was not free of contradictions as many plant breeders, particularly at INIA, pushed a modernisation model aligned with the Green Revolution, as previously noted. In a way, INIA's improved chile varieties could be envisioned as a continuation of the Mexicanness of chile, whilst also incorporating market-friendly and standardised qualities, in line with the *hortaliza* group uniformity concerns.

This vision about the future of chiles can be usefully understood through Jasanoff's concept of sociotechnical imaginaries, which she describes as "collectively held and performed visions of desirable futures…animated by shared understandings of forms of social life and social order attainable through, and supportive of, advances in science and technology" (2015, p. 19). The researchers involved in chile research and conservation shared an imaginary of improved-commercial chiles and native ones, informed by the *hortaliza's* market imperatives and by sentiments of cultural identity. For them, the new commercial chiles were a continuation of native chiles in terms of Mexicanness, but also an obvious and necessary step for the future development of chile agriculture. This set of ideologies shaped chile's research agendas, projects and ultimately gave meaning to its technoscientific materiality in the form of new varieties and technological packages for farmers (Smith, 2009, p. 462). As such, the imaginary of chile research sheds light into how INIA researchers envisioned their goals, built discourses, and ultimately, how this was pragmatically embodied in the differentiated management of commercial and native chiles.

Figura 16. La gran variación que muestra el chile costeño es un reflejo de lo que existía en todos los tipos de chile, antes de que se obtuvieran cultivares mejorados.

Figure 2.2 *The local landrace of chile costeño. In contrast to Figure 2.1, this landrace reflects heterogeneous and irregular characteristics (Laborde & Pozo, 1982, p. 54).*

Not surprisingly, one of the characteristics that INIA breeders thought necessary to preserve was flavour. This component always remained crucial, for both commercial and domestic motivations. For example, while describing *jalapeño* chiles, Laborde and Pozo draw a clear line between the *jalapeños* produced in Veracruz and Oaxaca and the *jalapeños* produced in Chihuahua for exportation. The *jalapeño* chiles produced in Chihuahua, with American seeds, particularly the types "M. Americano" and "Early Jalapeño", presented a "pungency in the palate but they do not have the typical flavour of jalapeño and therefore they are rejected by the Mexican industry, but nevertheless exported to the US" (1982, p. 29). Moreover, while describing chile *ancho*, Laborde and Pozo emphasise that immature fruits are consumed fresh, mostly as stuffed chiles, while mature ones are dried and then used for *salsas* and *moles* (1982, p. 34). Also, while comparing the general type of chile *ancho* with the *mulato* (which is a regional type of ancho from central Mexico), authors state that despite their similarities, "there are clear differences between both in the moment of preparing regional plates, since both have specific uses that are well-known by the peoples that prepare them" (1982, p. 36) (Figure 2.3). Developing Mexican flavoured chiles for the domestic market was essential to maintaining their identity and belonging as Mexican scientists.

Figura 10. El chile mulato es parte importante de la riqueza gastronómica que hay en México. Su coloración achocolatada a la madurez lo diferencía del ancho.

Figure 2.3 *Chile mulato. Laborde and Pozo describe it as an important component of the gastronomic richness of Mexico (1982, p. 37).*

Seemingly then, INIA scientists' imaginary of chile was anchored in this symbolic component – related to its flavour and appeal to Mexican palates – paired with the quest for a commercial and marketable chile product. The "ideal" chile was one with particular size, colour, spice and flavour, depending on the variety and region. For example, Laborde and Pozo described how jalapeños and *serranos* should be for their successful commercialization (1981, 1982) and state that there are "important aspects", such as size (an ideal of 6-8 cm for both), a conic shape, medium pungency, bright green colour for jalapeño and dark green for serrano, and "The peduncle must remain attached to avoid rapid dehydration ... This characteristic is decisive for the acceptance of the housewife" (1982, p. 46). The ideal chile even had specific buyers: women, imagined as in charge of home cooking and experienced in identifying the best chile for culinary purposes, and thus, the ultimate judges of chiles in the market.

This reflects the belief systems and shared understandings of social structure that chile breeders held and which ultimately informed the future of chile production and agriculture (Jasanoff, 2015; Smith, 2009). The imagined "housewife", the main buyer and consumer of

these improved chiles, was associated with a specific socio-political context. As industrial production of chiles was generally thought to serve urban lifestyles, where people were more inclined to judge the aesthetics or homogeneity of shape, texture, size, and colour, here I argue that these housewives were envisaged as urban middle-class buyers. This conceptualisation suggests that gendered trait preferences influenced chile breeding strategies under a nation-building effort. That is, "modern" urban middle-class housewives would buy the more "modern" Mexican chiles (Long Solís & Vargas, 2005; Nasirumbi et al., 2023; Pilcher, 1998).

More so, the inclusion of urban housewives into INIA's chile breeding research reveals not only a gendered vision of social roles, but wider – albeit connected – conceptions of class and race, present in Mexican nation-building discourse on *mestizaje.* The idea of the *mestizo* (a mix of European and Indigenous heritages and peoples) as a unifying race bloomed in the early twentieth century and solidified in Indigenista policies under the National Indigenist Institute (INI), where the assimilation of all Mexican cultures was thought of as a positive initiative to assert a sense of nation. Even when Indigenista policies shifted towards a revalorisation of the diversity of cultures and ethnicities in the 1970s and 1980s with the work of intellectuals such as Margarita Nolasco and Guillermo Bonfil Batalla, the legacies of mestizaje – where the inequalities of racial hierarchies tend to be obscured under the banner of unity – linger to the present day (Wade et al., 2014). Landraces and improved varieties, in this context, have related not only to plants and agriculture but have been shaped by socio-political dynamics, where both crops and humans have actively shaped each other (Hartigan, 2017). Chiles, as Mexicans, would eventually be uniform, for the sake of the nation's consolidation.

In believing that chile local landraces would eventually be replaced by commercial and improved chiles, the wider social perceptions of indigeneity and Mexicanness indicate that, in a way, local chiles, as local populations, would eventually mix and become "modern" – alongside entire groups of people. This is shown in the scientists' discourse around chile's management in peasant communities in Southern Mexico as rudimentary or coming from a "low cultural level" (1982, p. 23) and thus in need of modern technology. Also, from their gendered and racial assumptions on urban housewives as the main buyers of improved chiles,

where indigenous and local women – producers and experts of chiles themselves – were not considered.

In this sense, chile was developed as a product by INIA's programme of genetic improvement, directed towards a national market, intersecting with ideals of Mexican cuisine, gender, race, and identity. This, however, was set in the contradictory context of independent national research building whilst perpetuating a model of agricultural modernisation, previously imposed by foreign intervention. Researchers conceptualised the replacement of local and heterogenous chiles with improved ones as a natural step towards the "modernisation" of chile production – an ideology that reflected the broader context on nation building and progress. The imaginary held by these scientists envisioned that new chile types would be as Mexican as the native ones since they would be developed by Mexican researchers for consumption in a consolidated nation.

These contradictory positionings were no less present in the conservation section of INIA and on the approach given to chile landrace diversity. Turning towards the creation of future improved chiles, an official strategy of collection and conservation had to be put in place in order to ensure the use of native materials. Under this framework, chile seed collections and genetic resources conservation were institutionalised within the Chile Programme and the Genetic Resources Unit.

Chile Genetic Resources Conservation and Seed Collections at INIA

In 1977, INIA undertook a general evaluation of the chile collections inherited by the OEE. The evaluation revealed concerns spanning the following: a disconnect between chile projects within different INIA Research Centres, the lack of information on accessions in the collections, lack of a manual or computational systems where all data could be gathered, no systematic landrace collection efforts, genetic erosion caused by improved INIA varieties (such as with *Tampiqueño-74*), and poor infrastructure (precluding long-term seed maintenance through effective temperature and humidity control systems) (Laborde & Pozo, 1982, p. 78).

To address these issues, it was decided that the Experimental Station at Bajío, Guanajuato, Central Mexico, would become the main collection for chile genetic materials,

perhaps because of its central location or its importance as an economic hub for chile.[6] Subsequently, seeds were requested from the INIA's stations which held chile materials. Also, plant breeder Dr. Paul Smith from the University of California at Davis collaborated by contributing a duplicate of each exemplar from his original chile collection, which encompassed domesticated and wild varieties from South America (Laborde & Pozo, 1982, p. 78; Muñoz & Pinto, 1966). With all this new material, it was evident that a data organisation system would be fundamental. It was then that collaboration with "experts of other countries" was sought, and INIA adhered to the International Board for Plant Genetic Resources' (IBPGR) "Descriptors of Chile", which refers to an international format for plant genetic resources data that includes characteristics like country of origin, evolutionary history, genus, and geographical coordinates (FAO, 2015; IPGRI, 1995). This was incorporated into computational data collection efforts by the Genetic Resources Unit in 1980 (Laborde & Pozo, 1982, p. 78).

Therefore, from the 1980s onwards the collection and conservation efforts at INIA would be aligned, at least in official terms, to a wider international description and data management system, particularly to that of IBPGR. Since its foundation in 1974 by the Consultative Group on International Agricultural Research (CGIAR), the IBPGR aimed to coordinate plant genetic resource conservation on a global scale with the collaboration of national and international institutions. Here, they identified *Capsicum sp.* as one of the ten vegetables to be given priority in their programme for germplasm collection and conservation, mainly because of its "usefulness" in rural development and its generally high economic value in the tropics (Belleti & Quagliotti, 1983, p. 406). This came with the encouragement to collect, conserve, and classify Capsicum varieties all around the world (Casas, 2002).

This collaboration was described as a cooperative programme with the FAO, through the IBPGR, where a systematic collection of chile landraces across Mexico was to take place. The partial results that Laborde and Pozo published in 1982 indicate that 219 chile samples, mainly of the wild variety chile *piquín,* were collected in coastal states such as Veracruz,

[6] The reasons for this choice are not evident in the literature I have accessed to date.

Tabasco, Quintana Roo, Sonora, Nayarit, and Jalisco. Yet, collection efforts in southern states such as Guerrero, Oaxaca, and Chiapas, were very limited. This was the first time an initiative encompassed a wider selection of chile landraces, in addition to commercially valuable ones (1982, p. 78). However, chile collection efforts remained mostly focused on domesticated and commercial varieties in the next two decades due to lack of resources and personnel (Moisés Ramírez Meraz, personal communication, 2021). Indeed, INIA suffered significant budget cuts during the 1980s because of the petrol crisis that struck Mexico in 1982 (De la Fuente Hernández et al., 1991, p. 15).

Meanwhile, the main objective of the centralised Chile Germplasm collection in the Bajío Experimental Station was to develop new and improved varieties using the 2000 available accessions of domesticated and, to a more limited extent, wild varieties of chile, as well as with some other seeds from America, Europe, and Asia (Pozo, 1981, p. 4). At the same time, scientists envisaged that these improved varieties would cause an inevitable genetic erosion of landraces and thus the seed bank would also act as a safe reservoir for chile local varieties. As Laborde and Pozo state:

> "Efforts to improve production have led to the creation of new varieties, which are more productive, uniform, resistant to diseases, and of better quality, which is why they are accepted by farmers, who do not re-plant their highly variable creole types… where the new materials were selected from. The same fact causes two different effects: on the farmer's side, a more productive and remunerative crop... but another effect is the almost immediate disappearance of different types of chile... Remembering that variability is required for any breeding programme, we can appreciate the national and international repercussion of this" (1982, p. 77).

For these researchers, the importance of conserving chile materials represented an international responsibility, as they took into consideration the worldwide economic, culinary, and industrial uses of chile. In this calculation, they reduced landraces to raw genetic material, portraying their variability as detrimental for production.

These researchers also offered celebratory nationalist arguments related to chile diversity to convey the importance of conserving this crop. They contended that:

> "It is common for Mexicans to classify the chile as a plant that fully identifies with their nationality, since its daily use is not limited to a specific social or economic stratum, because at lunchtime chile is omnipresent in any locality of the country, whether in lowlands, highlands, mid-lands, dry or humid tropics or burning desert. This is of course not an expression of the modern world of "consumerism" but on the contrary, it dates back thousands of years to the inhabitants of Mesoamerica. This custom, instead of disappearing with the Conquest, received a new impetus when the Spanish customs were combined with the indigenous ones and resulted in the current Mexican Creole cuisine, which uses a wide variety of chile types" (1982, p. 76).

This quote reinforces the argument presented before regarding the contradictory sets of values regarding chile diversity in INIFAP: on the one hand, the diversity allowed for such an expanded and symbolic use of this crop, on the other, chile reads as a unifying, even homogenising, element of Mexican culture. More so, it presents chile as an input in making an industrial commodity, and it recognises its flavour and use in traditional Mexican cuisine. This speaks to how the researchers' chile imaginary was informed by a belief-system that merged industrial agriculture and a nation-building discourse. Chile researchers presented their object of study as reaching *all* Mexicans. They saw chile as a unifying emblem that solidified in common culture traditions, such as in a national cuisine (Pilcher, 1998).

Despite their claims of chile's centrality to Mexican food and culture, researchers' fear of losing landraces does not seem to have originated from concerns about losing traditional plates and cuisines. Rather, it was linked to concerns about the loss of material to develop new improved chile varieties. Describing chile as synonym of Mexican identity allowed INIA researchers to claim "ownership" of this area of research, something they could appropriate as of their own *making*, as their *own* material. This is underlined with their direct opposition to chile diversity as being "an expression of the modern world of consumerism" powered by

developed countries, mainly the US, which can be read as an attempt to disassociate from foreign research. In other words, according to them chile's diversity did not emerge from Western consumerism but from Mesoamerican roots. Yet, the future of chile would inevitably be one of standardisation of types to achieve ideals of modernisation and production – but led my Mexican scientists. This means that within chile's conservation, as in its breeding, diversity was linked to chile's cultural symbolism and as a crop that enacted and forwarded Mexicanness. However, this diversity was still to be collected and eventually, improved.

Moreover, the intersection between commercial and landrace chiles in the scientists' discourse reveal other aspects of Mexican agriculture that are worth noting. For one, by tying chiles both to Mexican identity and to all people, researchers also put forward a message that their research and technology was out there for *everyone* to access. This was in line with INIA's objective to increase crop production and to improve production conditions in *all* rural Mexico. Scientists indeed worked to reach all producers and *campesinos* and to increase production and revenues in the agriculture sector. They were however, embedded in a larger panorama. Chile research was allocated to specific INIA stations in regions where chile was a widely cultivated crop. This means that regardless of the personal interest of scientists to work or develop technologies for other regions or farmers, they were influenced, and sometimes limited by, pre-ordained priorities and finite institutional resources (Moisés Ramíres Meraz, personal communication, 2021).

This reflects the kind of producer that was the real target of INIA's new chile varieties and technological packages. As Suárez claims, "These lines [of research in INIA] have corresponded more to the needs of the most prosperous and technified agricultural areas, than to the requirements of the peasants themselves… marginalising most of the agricultural sector from the results of the research" (1982, p. 86). By concentrating chile research and conservation in northern and central states, the access of INIA's varieties or accessions in the banks was localised in more prosperous areas where infrastructure such as irrigation was more readily available. Also, it was accessible only to farmers with the means to buy and apply these technologies. For example, Laborde and Pozo mention that by 1982, 80% of the national cultivated area was managed by irrigation, while only 20% depended on rainwater in states like Oaxaca (1982, p. 18).

These contrasts in the agricultural sector continued to exacerbate marginalisation of small and subsistence producers throughout the 1980s and 1990s, who faced growing levels of poverty and malnutrition (Cotter, 2003). To tackle poverty and food insecurity, the state perpetuated and expanded subsidies for subsistence production and basic foods such as milk, tortillas, and beans through the CONASUPO. On the other hand, *hortalizas* occupied the opposite side of the spectrum: with a solid domestic niche and a growing export market, the production of *hortalizas* (and other crops such as tropical fruits and cotton) would be pushed so that their revenues cushioned the growing grain imports (González, 2019). In line with international and domestic conceptualisations of food security, the strategy of focusing on cheap calories to "affordably" avoid famine, placed *hortalizas* as a token to import these cheap calories (Carolan, 2013). Thus, agricultural crop groups came to be related with different types of calories depending on the market they belonged to. In this case, chile as a product in the market would be accessible by those who could afford it,[7] while the revenues would be useful for the importation of cheap calories to feed the population.

The growing social contrasts would only accentuate in decades to come. With the implantation of stronger neoliberal policies in the 1980s and especially in the 1990s, the agricultural sector would drastically change and with it, the scheme of chile production.

INIFAP, NAFTA, and a New Age for Chile Commercialisation

In 1985, the Mexican government decided to unify INIA with the National Institute of Forestry Research and the National Institute of Livestock Research to form the National Institute of Forestry, Livestock and Agricultural Research (INIFAP). The latter, according to the state's celebratory publication of the 35th anniversary of INIFAP, had the goal of merging human resources and infrastructure to fortify the scientific and technological output, and therefore to increase the productivity of the forestry, livestock, and agricultural sectors altogether (Cruz

[7] Of course, in many localities chile is grown in house gardens, obtained from wild varieties, or bought from local markets or *tianguis*. A significant part of the commercialization and consumption of chile is not part of the industrial agriculture economy (Aguilar Meléndez et al 2018).

& Reyes, 2020, p. 19). This, however, seemed not to interfere much with the ongoing chile research at INIFAP's agricultural stations. As Moisés Ramirez Meraz recalled, it was mostly an administrative turn, and chile research stayed pretty much the same before and after INIFAP's consolidation (personal communication, 2021).

However, in a wider perspective rural Mexico underwent striking changes of policy. With the 1982 petrol crisis, and the failed restoration of staple crop self-sufficiency, during the administration of Miguel de la Madrid (1982-1988) neo-liberal policies were implemented and subsidies to agricultural producers were considerably reduced (Kinchy 2012, p. 35). This neoliberal ideology was spread globally during the 1980s and 1990s, through the establishment of free trade agreements and along with the General Agreement on Tariffs and Trade (GATT) (later on the World Trade Organization), which Mexico joined in 1986.

The real watershed with respect to open markets and neoliberal policies in Mexican agriculture came with the administration of President Carlos Salinas de Gortari (1988-1994). For one, the Law of Production, Certification and Commerce of Seeds (1961) was modified in 1991, so that restrictions for the private sector in terms of research, production, and commercialization of seeds were lifted. This led to the eventual dismantling of PRONASE and ended the state's monopoly in this terrain (Luna Mena et al., 2012). However, the more significant turning point for Mexican agriculture was the North American Free Trade Agreement (NAFTA), signed in 1992 and put into effect in 1994.

At a general level, NAFTA instantiated further industrialisation of agriculture, the privatization of *ejido* lands (thus marking the end of the state's alignment to *agrarismo)*, but above all, the prioritisation of export crops to maximise profit in international trade.[8] This meant a turn of strategy in the sense that efforts for domestic production of staple crops would be supplanted by the importation of cheap grains from the US (Fitting, 2011; Kinchy, 2012). The opening of markets was aimed (among other outcomes) at reducing jobs in the countryside by modernising agriculture, and thus creating a bigger workforce for the

[8] The instauration of NAFTA provoked social resistance such as the movement of the *Ejército Zapatista de Liberación Nacional* (EZLN) in 1994, especially in peasant and indigenous communities.

industrialised urban centres. However, these economic strategies fostered the already increasing inequalities, especially for small-scale producers, and mass migration to the US (Fox & Haight, 2010, p. 11). To cushion the changing prices and growing unemployment, the government created social programmes, such as the Programme for Rural Support (PROCAMPO), which granted direct economic support to farmers depending on the size of cultivated area (García-Salazar & Ramírez-Jaspeado, 2015). Notwithstanding these interventions, agricultural employment declined by 28% between 1993 and 2010 (UNCTAD, 2014, p. xv).

Under NAFTA, the *hortaliza* sector, and therefore the chile industry, underwent significant transformation. For one, the modification of the seed law in 1991 mentioned above, and that of the Mexican Federal Law on Plant Varieties in 1996 (aligned with The International Union for the Protection of New Varieties of Plants, which favoured a profit and property-rights based system of seed development) (Kinchy, 2012, p. 36), opened the door for transnational and private companies to target *hortaliza* and fruit Mexican production. Private enterprises grew to dominate most of the seed market in *hortalizas*, and by the mid-1990s around 40% of the total value of seed sales derived from imports (INIFAP, 1996, p. 40). By 1996, 89.5% of chile production used improved seeds (INIFAP, 1996, p. 41). Moreover, by 2000, the private sector accounted for 74% of certified seed production, whereas agricultural and farmer organisations accounted for 16% and the public sector represented only 10% (Ramírez et al., 2000).

Without trade restrictions, the prices of export crops rose as part of a growing demand in the US and Canada. This was a profit opportunity for medium-to-large scale farmers with irrigated lands, the necessary infrastructure to produce at an industrial scale, and for those able to comply with American and Canadian quality standards. Indeed, producing tropical fruits and vegetables in Mexico was cheaper and more viable than producing them in the US or Canada. As such, the exportation of *hortalizas* and fruits represented 57% of the agricultural sector's income in 1997, with tomato, cucumber, pepper, squash, chile, onion, garlic, aubergine, mango, guava, watermelon, and lemon as the most relevant crops (Ramírez et al., 2000).

Year	1992	1993	1994	1995	1996	1997	1998	1999	2000
Irrigation Production (tons)	1,139,904	1,042,650	836,935	1,039,299	1,071,436	1,600,957	1,630,013	1,623,845	**1,564,960**
Irrigation Value (thousands of Mexican pesos)	2,497,686	2,137,412	1,580,248	2,252,142	2,555,170	5,117,759	6,321,580	5,851,517	**6,613,077**
Rainwater Production (tons)	135,796	177,117	150,550	154,097	146,396	162,599	229,758	176,308	**176,719**
Rainwater Value (thousands of Mexican pesos)	318,109	514,117	454,828	490,961	404,192	485,072	839,530	660,888	**724,717**
TOTAL (Irrigation + Rainwater Production)	**1,275,799**	**1,219,767**	**987,485**	**1,193,396**	**1,217,797**	**1,763,556**	**1,859,772**	**1,800,154**	**1,741,680**
TOTAL (Irrigation + Rainwater Value)	**2,815,795**	**2,651,529**	**2,035,007**	**2,743,104**	**2,959,362**	**5,602,831**	**7,161,111**	**6,512,406**	**7,337,795**

Figure 2.4 *Table showing chile production in the period 1992-2000. Information obtained from the Agri-food and Fisheries Information Service (SIAP): https://nube.siap.gob.mx/cierreagricola/.*

In line with the latter, chile production and export skyrocketed in Mexico in the following years after NAFTA, as its production dropped in the US. Chile was, and still is, one of the main agricultural products exported to the US from the beginning of the treaty (Centro de Estudios de Finanzas Públicas, 2000, p. 80; Gandonou & Waliczek, 2012, p. 365; Mella & Mercado, 2006). According to the state's Agri-food and Fisheries Information Service (SIAP), chile's value escalated alongside its production from 1992 until 2000 (Figure 2.4). Moreover, irrigated chile encompassed 89% of the national production, and between 88 and 90% of the total chile revenues. The main regions of production remained the Centre-North of the

country, namely Guanajuato, Sinaloa, Zacatecas, San Luis Potosí, and Durango (Ledezma Mares & Ruiz Garduño, 1994, p. 5). This means that in general, industrial production increasingly dominated the market, whilst chile production in non-irrigated and small-scale terrains grew but not to the same extent. As will be explored further on, the accelerated production of industrial chiles and their ubiquity in national and international markets has been linked the loss of endemic and local chiles, as the latter have become more expensive than those industrially produced and therefore, inaccessible to many.

In this sense, chile production underwent two significant changes post-NAFTA: first, export chiles diversified to encompass not only those varieties strictly meant for exportation anymore. As Morris & Skaggs (2004) explain, imported chiles to the US during the period of 1998-2003 were mainly bell peppers, jalapeños*, anchos* and a growing tendency of "other capsicum imports", which suggests that the US demand for more chile varieties was growing. As such, Mexico became the most important chile provisioner for the US (Gandonou & Waliczek, 2012). Second, domestic production would now use foreign seeds to produce typical Mexican chile varieties. That is, without the state's monopoly, private initiative and foreign companies could sell improved seed varieties to Mexican producers. In other words, the pre-NAFTA scheme was one where export chiles encompassed specific varieties produced *only* with American seeds *only* for the export market, and the domestic production was produced *mostly* with INIFAP seeds. However, post NAFTA private companies' seeds *and* INIFAP seeds supplied the export and domestic markets.

Rather than being mainly a domestic commodity, chile production now had to comply with the export market's quality standards, particularly to that of the US. This meant further standardisation of chile types, and a decreased role of the state through INIFAP in the breeding of varieties. In this sense, the initial differential between domestic and export production of commercial chiles was breached. The private sector encountered a profit opportunity with the commodification of Mexican traditional foods in the post-NAFTA era, as Mexican migration to the US escalated, and with it, the exchange, movement, and fusion of products, ideas, and people became easier than before (Gálvez, 2018). Chiles, representative ingredients of Mexican food, found a new hub for the millions of people that sought belonging and identity through food, in the impossibility of connecting to their territories of origin. In

addition, a growing interest from American communities in different types of spice and flavours draw attention to chile (Lillywhite et al., 2015; Pilcher, 2008, 2017; USDA, 2008). Cultural mix and renewed traditions, then, forwarded chile production and markets not only in Mexico, but abroad.

Parallelly, global motions to conserve crop genetic resources entered a new phase. As the opening of global markets took place, increasing worries about climate change, environmental degradation, and biodiversity loss occupied a central role in the agenda of international organisations concerned with the conservation of natural resources and food security. Among the most relevant of these was the United Nation's Convention on Biological Diversity (CBD), signed at the Earth Summit in 1992. It was the first of its kind as it encompassed concerns over the conservation of species, ecosystems, and genetic resources together, and recognised the protection of these as an essential part of social development (CBD 1992). Moreover, in 1996 the Food and Agriculture Organization celebrated the World Food Summit, where "food for all" underscored ongoing global anxieties since the 1970s in relation to famine and lack of sufficient food supplies, particularly in developing countries. In the same year, La Via Campesina presented its manifesto, in which it introduced the term "food sovereignty", emphasising access to culturally appropriate foods, autonomy of means of production and agricultural practices for farmers and peasant communities around the world (Via Campesina, 1996).

In line with these international collaborative frameworks, the Mexican state implemented evaluation studies of crop genetic resources during most of the 1990s and early 2000s. Moreover, the government's alignment to international environmental initiatives was also reflected in the creation of institutions such as the National Commission for the Knowledge and Use of Biodiversity (CONABIO) in 1992 and the Ministry of the Environment, Natural Resources and Fisheries (SEMARNAT) in 1994. The implementation of the General Law of Ecological Equilibrium and Environmental Protection in 1996 (which inserted the term biodiversity in the constitution) (Ramírez et al., 2000, p. 130) and the creation of natural reserves were also landmarks of this period. All these initiatives would be steppingstones for later efforts in landrace collection and conservation in the management of plant genetic resources.

Yet, resources were not equally distributed. As INIFAP's budget decreased, the lack of resources limited the maintenance and expansion of chile seed collections (Salvador, 1992). This means that during the 1990s, INIFAP's focus on chile research remained that of industrial production and genetic improvement. For example, Zacatecas Experimental Centre started to evaluate chile seeds during the 1990s, especially *puya, mirasol, ancho,* and *guajillo* chiles (Reveles-Torres & Velásquez-Valle, 2017, p. 4). Also, in 1995 the Southern Tamaulipas Experimental Centre started a project on chile *serrano* genetic improvement which resulted in the successful *Coloso* variety in 2001 (Ramírez Meraz et al., 2007), and in the same year new *guajillo* varieties were developed in Palma de la Cruz Experimental Station, in San Luis Potosí (Ramiro Córdova, 2001). Also, chile researchers undertook general studies on chile fungal diseases using the genetic material of the Bajío germplasm bank, which remained INIFAP's central chile collection (Montes, 1999).

More so, general national reports on the evaluation of Mexico's plant genetic resources were undertaken by INIFAP, SNICS, and the Mexican Society of Plant Genetics (SOMEFI) in line with FAO's framework (INIFAP, 1996; Ramírez et al., 2000). Here, researchers surveyed the state of conservation projects, international collaborations, the use of plant genetic resources, their legislation, and the potential future actions to ensure their preservation. Scientists called for an increase in budget and personnel for the maintenance of germplasm collections, and the need of establishing a national policy framework regarding genetic resources (a call that first emerged in the 1970s, as previously mentioned).

Here, INIFAP scientists stated that chile represented one of the biggest INIFAP collections with 3857 exemplars of six *Capsicum* species (*C. annum* being the most represented species, with varieties such as jalapeño or *serrano).* However, they pointed out the general need of improving the infrastructure of the collection, and the need to refresh 30% of the chile reservoir. Moreover, these reports also indicated the lack of information concerning chile's genetic pool from 20-40 years ago, which, paired with the displacement of landraces for improved varieties, left an impossibility of knowing the "actual state of genetic erosion" of the crop (INIFAP 1996, p. 31). Despite the scientists' call for better infrastructure to expand chile research and seed collections, the lack of funding limited the work that *agrónomos* could undertake in terms of conservation (Moisés Ramírez Meraz, personal

communication, 2021). This, paired with a diminished state control over the domestic chile market, obliged INIFAP's scientists to reduce activities concerning the curation and expansion of seed collections.

Interestingly, these evaluation studies classified chile, together with maize, beans, and squash as one of the most important crops for the "diet of the Mexican people" and as one of the "most important crops" in the country (INIFAP, 1996, p. 10-12; Ramírez et al., 2000, p. 43). This threads to INIA scientists' early discourse on chile: albeit not a caloric crop, chile had been, and remained, basic for the Mexican diet and culture for agricultural scientists all along. Yet so, defining aspects of chile research in the 1970s and 1980s – such as the conceptualisation of landrace diversity as breeding material and the imaginary of women as buyers – would slowly change through the 1990s and, more emphatically, in the dawn of the twenty-first century.

Ironically, the growing standardisation and homogenisation of commercial chiles, championed during these decades, accentuated the distinction between these and native chiles. Whilst the state's agricultural policy continued to push for the industrialisation of the countryside, a parallel interest in local chile varieties and their cultural value emerged in Mexican academia. On the other hand, chile landraces were also kept alive within a different scheme outside institutional halls; mostly through regional exchange, home-garden cultivation, wild collection, and very importantly, through local cuisines (Aguilar Meléndez et al., 2018) as will be detailed in the last chapter.

Conservation and research opportunities would emerge at the turn of the century for chile *agrónomos* from various institutions as state initiatives on biodiversity conservation and food security prompted the creation of the System of Genetic Resources for Food and Agriculture (SINAREFI) in 2002. This new institution forwarded interdisciplinary collaboration and the study of local varieties of native crops. As such, chile *agrónomos* would begin collaborating with two disciplines that had parallelly bolstered chile and crop studies from the 1970s, albeit from a contrasting intellectual and socio-political standing: ethnobotany and agroecology.

Chapter 3 : The Counter-Revolution

Whilst state-led agricultural production continued to incentivise the industrialisation of rural Mexico through the 1970s and 1980s, the aftermath of worldwide Green Revolution (GR) projects led to the realisation that economic, social, and wellbeing disparities had not been bridged. If anything, the gaps had been accentuated. Fears about genetic erosion, marginalisation of peasant groups, environmental hazards, and food security compelled international organisations to articulate projects critical of industrialised agriculture and capitalised systems from the 1970s. The FAO´s World Food Conference in 1974 and the United Nations Research Institute for Social Development were key examples of research and discussion focused on tackling the social and environmental impacts of a GR-modelled food system. Yet, these were markers of broader unrest.

The growth of politicised movements in the 1970s and 1980s was particularly evident in Latin America. Growing social concerns about environmental degradation, the neglect of peasantry and indigenous peoples, and the political turmoil over authoritarian states (propelled by developed countries) sparked social movements throughout Latin America as the Cold War unfolded. Events such as the Cuban Revolution, the Central American agrarian struggles, and the international student movements resonated deeply in the social and political landscape of Latin America. In Mexico, the student Tlatelolco Massacre of 1968 marked a turning point for repressive state politics and highlighted the generalised discontent over evident inequalities. In addition, the government's strategy for rural development remained that of modernising agriculture, but in the early 1970s, production decreased, and the importation of staple crops created public doubts on the GR's true effectiveness (Appendini, 2001).

Latin America´s biological richness, as well as its cultural and ethnic diversity, drew the attention of researchers investigating alternative ways of enhancing ecologically friendly food systems. This paved the way to an intellectual and social movement that instantiated groups of scientists to go beyond the confines of academic institutions from the 1970s (Altieri & Toledo, 2011). This social unrest was reflected in the Mexican academic sector, as anti-imperialist views sparked renewed interest in Mexico's own cultural and biological richness (Cotter, 2003; Gliessman, 2013). Drawing on this panorama, the development of ethnobotanical and agroecological studies in Mexico commenced to integrate social and political perspectives to advance alternative modalities of agricultural production.

In this chapter, I will present an outline of the movement propelled within ethnobotanical and agroecological – and later, ethnoecology – research in Mexico against GR-like models of agriculture and how it influenced crop studies and conservation in the country between the 1970s up to the 1990s, focusing on chile. I use the term "counter-revolution" in reference to these scientists' efforts to build a countermovement to industrial agriculture through including "traditional agricultural knowledge" into their research. I propose this term because these scientists sought a drastic change in rural development – as big in scale as the GR had been – and thus proportionally "revolutionary".[1]

Curiously, as ethnobotanical and agroecological studies flourished from the 1970s onwards in Mexico, chile seems to have been neglected in these early counter-revolutionary efforts. For a crop symbolic of Mexican identity and diversity, this stands as a perplexing fact. Why were there so few chile studies, even when ethnobotanical and agroecological projects skyrocketed in this period? In this chapter, I present a twofold explanation to this question. First, I show that ethnobotanists and agroecologists had the main objective of countering monocrop industrial agriculture and its socio-environmental consequences, which paved the disciplines' trajectory as a political endeavour. This means that special attention was given to

[1] In addition, this countermovement also resonated with legacies of the Mexican Revolution. For example, Gutiérrez Núñez (2017) comments on how Mexican historiography in the 1970s and 1980s focused on peasant movements during the revolution and during the agrarian reform (p. 20).

traditional systems as a whole rather than to individual crops like chile (except for maize and beans).

However, the early counter revolutionary research on ethnobotany and agroecology did not directly oppose the Green Revolution and its consequences in Mexico, as is often claimed in the literature. There were some important continuities between early critiques of the GR and those scientists promoting it. Influenced by the period's *indigenista* policies, both approaches emphasised rural development and the partition of rural Mexico into a "modern" nation, related to industrial agriculture but also to science and emerging technologies, and a "traditional" peasant and/or indigenous element (Dillingham, 2021). In a way, this essentialisation and division perpetuated the gap between ideas on progress and primitivity in rural Mexico. Chile did not fit neatly within these dichotomous categories.

Second, I discuss how these scholars' dynamics of knowledge building, particularly with regards to the framing of "the traditional", were inevitably gendered. Through their descriptions of local agricultural techniques, ethnobotanists in the 1970s and 1980s assigned greater agency and responsibility to male peasants or campesinos for the diversification of crops and the development of agricultural techniques. They framed women merely as a part of the family unit, but not as central actors in agricultural methods per se. Therefore, women were included only as secondary actors in a male-dominated narrative. This shaped how chile would be studied with respect to heritage and culinary knowledge for the following three decades.

Chile would only begin to be studied individually in the 1990s. Ethnobotanists, agroecologists, and ethnoecologists in this period aimed at overcoming the duality of "modern" and "traditional" agriculture that had formed the initial basis of their fields of study and of the counter-revolution. That is, the contrasting discourse from the early critiques in the 1970s and 1980s changed by the 1990s to encompass calls to integrate a "sustainable development" agenda, which put forth an ideal of meeting human needs without compromising the balance of natural systems. Within this global movement, scientists in ethnobotany and agroecology in Mexico pushed for stronger crop genetic resource conservation efforts. They emphasised the need to develop *in situ* conservation strategies

alongside local populations, rather than an absolute centralisation of diversity seed banks. This signified a starting point for chile-specific studies in Mexico.

More so, ethnobotanists, agroecologists, and later ethnoecologists increasingly emphasised the relevance of culture in understanding and conserving biological diversity. Within this approach, these scientists increasingly recognised food preferences and practices as being intrinsically connected to food systems, conservation, and food security and sovereignty. Here, they named chile as a basic crop along other *milpa* crops such as maize and beans. However, they described chile as *basic* in terms of flavour, availability, cultural traditions, and nutritional value – in contrast with more mainstream definitions of "basic crops" related to calories and grains. Therefore, this group of academics contested, on their own terms, the rationale of dietary and nutritional needs as defined by institutions such as the National Institute of Nutrition (INN) and the FAO (Casas et al., 1994).

By tracking these changes in ethnobotany and agroecology (and ethnoecology from the 1990s), this chapter outlines the ways in which researchers, by shaping their own role in the national agricultural scene, constructed the value of local or traditional cultivation systems. Drawing on this line, their construction of chile was tied with their research identity and their conception of nation building, based on *the traditional* – in contrast with other chile research groups in the country such as plant breeders at INIFAP. Scientists working in agroecological and ethnobotanical projects then served as a bridge between academic institutions and the state, and local peoples or communities. Through their investigations, they managed to link traditional knowledge with scientific research and academic studies. By opposing industrial agriculture and capitalist policies, these scientists pursued an agenda where the protection of what a later generation would call "biocultural heritage" seemed the most promising alternative for rural development in Mexico.

The structure of this chapter is as follows. I first explore the broader context of the transformation that took place in ethnobotany and agroecology in the 1970s and 1980s, centring on the work of Efraím Hernández Xolocotzi, a defining character in the so-called "revolution" of these fields. I then unveil how Mexican ethnobotanic and agroecological researchers framed traditional agricultural knowledge as the main alternative for Mexican rural development. Here, I discuss how this early counter revolutionary research neglected

the role of women in local farming systems, and, interestingly, bypassed chile too. Moving on to the 1990s, I account for how ethnobotanical, agroecological, and ethnoecological research forwarded a less essentialised division of the modern and the traditional and, parallelly, highlighted the interdependence between biological and cultural diversity, especially in relation to food systems. For this, I explain how researchers framed chile as a "basic crop" in terms of flavour, cultural preference, nutrition values, and local availability, and how they contested national and international statements on adequate diets and food security. Finally, I reflect on these scientists' changing intellectual incentives throughout these decades, and how they are fundamental to understanding the later bloom of chile studies and crop conservation research in the following century.

The Emergence of a Movement: Ethnobotany and Agroecology in Mexico

Ethnobotany has been broadly defined as the interface between botany and anthropology; in short, as a field that analyses the relationship between humans and plants (Hecht, 1999; Hernández Xolocotzi, 1970; Lira et al., 2016). As global movements unfolded in the 1970s, the field underwent significant modifications in its methods, questions, and purposes (Schultes & Reis, 1995). An increasingly large part of the discipline started to question the economic-based or utilitarian model that had typified ethnobotanical research for centuries (Hecht 1999).

In Mexico, a pioneer in this transition was Efraím Hernández Xolocotzi (1913-1991), born in the state of Tlaxcala to a peasant family that migrated to the United States in 1922. Achieving academic excellence from a young age, Hernández was able to make his way to Cornell University. There, he pursued a degree in agricultural science. This interest was motivated by a trip to Mexico after finishing high school where he was able to witness peasant life first-hand and the contrasting conditions of poverty and segregation that most small-farmer families experienced (Caire Pérez, 2016, p. 77). From this trip, he developed a profound interest in tackling the rural fragmentation he observed in Mexico's agricultural context.

As noted by Caire Pérez, it is curious that Hernández, an early and vocal critic of the GR, worked within its main institutions in his early years as an agricultural scientist. In 1945, Hernández began working as a germplasm collector in the MAP at the OEE. Through the OEE, Hernández was able to explore Mexican territory and develop an inclination towards campesinos' agricultural and botanical knowledge. However, he became disillusioned with the technocratic approach of the programme (2016, p. 104, p. 112). By the 1960s, now working as an established botanist at one of the main educational centres for agricultural science in Mexico, the National School of Agriculture (ENA), he articulated his critiques more clearly. Hernández voiced concerns over the adoption of foreign technologies and the neglect of the domestic socio-cultural context with their application. He explicitly recognised the knowledge of campesinos and indigenous populations with respect to their local environments (2016, p. 170). Thus, in contrast to his former colleagues at the OEE, Hernández presented local farmers as active agents in breeding and agriculture.

Yet, it was only after his 1968 trip to South America that Hernández came back as an ethnobotanist with radical views (Caire Pérez, 2016, p. 278). In this journey, Hernández integrated ethnographical insights to his knowledge of plants and agriculture, an interest that eventually brought him closer to the field of ethnobotany than to his initial path as an agricultural scientist. In the early 1970s, Hernández consolidated his views on plants and humans, especially the interactions of different cultures with their environments including through their local agricultural systems (1970; Hernández Xolocotzi & Alanís Flores, 1970). His vision for ethnobotany sharpened, and he differentiated his ethnobotany from that of the past. As he and colleagues stated:

> "Ethnobotany was initially established as the study of the use of plants by primitive cultures. We have now established that ethnobotany is the study of the mutual relations between man and the plants through the dimensions of time, space, and culture. This approach is expressed in the following way: ethnobotany is the study of the various ways that man has used to achieve the optimal use of renewable natural resources in order to obtain products that meet their anthropocentric

needs (generated by the same man) for the benefit of the human group" (Hernández Xolocotzi et al., 1975, p. 1).

Not only did Hernández challenge previous ethnobotanical research by promoting a more horizontal framework between local knowledge and academia, but he also emphasised the political aim of the field. For example, while describing the ethnobotanical histories of local populations in his explorations through Latin America, he positioned industrial agriculture as the destroyer of culture, writing "Slowly, day after day, for millennia, in all corners of human culture, the history [of local peoples] has been weaved – and whose beginning we still do not describe and whose end, in its elementary phase, is glimpsed before the use of improved seeds, the cultural dispersion of indigenous groups, industrial expansion, the mechanisation of agriculture and the coercion of agricultural dissemination" (1970, p. 8-9). Thus, his work on ethnobotany became a banner denouncing the negative consequences of the GR and revalorising native peoples' knowledge.

Under this context, agroecology emerged hand in hand with ethnobotany as a discipline that sought to counter the GR and to revalorise traditional agricultural knowledge. The newly installed field was often led by ethnobotanists themselves, such as Hernández (1977) and biologist Arturo Gómez-Pompa (1987). However, agroecology's theoretical genealogy parted from ecology (Gliessman et al., 1981; Wezel et al., 2009) rather than botany. This means that agroecology focused on a "systems" vision of the environment to generate socio-ecologically resilient agricultural techniques for food production (Altieri, 1999; Gliessman, 2013). In this sense, agroecology evolved as a more practical field, transcending academic halls since its inception and becoming a social movement with active participation of farmers, producers, and local peoples (Astier et al., 2017; Hecht, 1999).

With ethnobotany and agroecology as his disciplinary brands, Hernández largely promoted and cultivated interdisciplinary research and collaboration. As such, his work was taken as pivotal – and probably the most important motor of change, alongside anthropologist Guillermo Bonfil Batalla – in the valorisation of indigenous knowledge and agricultural systems in Mexico (Gliessman, 2013; Lira et al., 2016; Toledo, 1995). In fact, he linked approaches from anthropology to his botanical studies and collaborated with

acclaimed anthropologists such as Arturo Warman and Angel Palerm (Caire Pérez, 2016). Within this interdisciplinary framework he collaborated with and supported the programme "Traditional Agricultural Technology" (TAT), an interdisciplinary and inter-institutional endeavour. Through TAT he advocated the inclusion of peasant agricultural knowledge in rural development programmes, which had, so far, mishandled "attempts to improve the living conditions of the rural population" (1977, p. 321). In this sense, Hernández underlined ethnobotanists' role in linking traditional agricultural knowledge and technologies with institutional efforts for rural transformation through science.

Through the teachings of Hernández Xolocotzi, a new generation of ethnobotanists and agroecologists emerged in Mexico in the 1970s. The new cohort proceeded with degrees in biology and agricultural science at institutions like the University of Chapingo (UCh), previously the National School of Agriculture (ENA), the Postgraduate College (COLPOS), the National Polytechnic Institute (IPN), and the National Autonomous University of Mexico (UNAM). Moreover, there was a significant increase in the number of ethnobotanical works that integrated analytical approaches such as cultural, ecological, evolutionary, and theoretical ethnobotany. Descriptive and cultural approaches grew to become equally – or even more – relevant as theoretical tools than the conventional activities of economic botany (Camou-Guerrero et al., 2016).

The GR critical approach advanced by Hernández and the nascent generation of Mexican ethnobotanists and agroecologists was inserted in wider academic transnational conversations around the detrimental consequences of industrial agriculture, both in Mexico and in other regions of the world. These discussions pointed at the staggering inequality that the GR had deepened, despite its promises of delivering the opposite. Some of this GR critical research included anthropologist Cynthia Hewitt de Alcántara's study of modernisation in Mexican agriculture between 1940 and 1970, which highlighted the unequal distribution of investment between small and large producers (1976). Also, historian Barbara Tuchman noted that privately-owned farms and big producers were the ones that profited from the GR in Mexico, worsening the economic gaps (1976, in Harwood, 2009, p. 1246). With a broader geographical lens, economists Keith Griffin (1979) and Harry Cleaver (1972) argued that the technification of agriculture had widened the income distribution, accelerating inequality

rates, and benefitting mostly elites and industrialised regions. Thus, these accounts reflected the broader global unrest towards industrial agriculture in diverse academic fields, as well as the task of many scholars to mobilise for a global rural struggle, and of reframing agriculture and indigenous and *campesino* knowledge from a socio-political stance of resistance.

Taking these global conversations into account, alongside Hernández's inspiration in indigenous knowledge and interdisciplinary research, young Mexican biologists developed a more pointed political discourse regarding the role of ethnobotanists and agroecologists in combating the rural struggle that Western agricultural science had accentuated through the GR. For example, in 1979 Javier Caballero defined ethnobotany as an activity that had to deconstruct academic methods and address social change as a "radical discipline" by acknowledging the "popular science" built by indigenous populations. He described their knowledge as "obtained with methods and procedures largely equivalent to those of modern science, thus constituting a true popular science or concrete science" (1979, p. 13). Similarly, Alfredo Barrera in 1979 denounced the classism of academia and stated that "We [scientists] frequently place ourselves, identified with the ideology of the ruling class, as intellectuals who can treat the objects of our study with the superiority conferred on us by pretending to be able to do so with scientific objectivity and not with empiricist logic (also object of study) of our informants, belonging to different cultures and subcultures that are not always well understood and even underestimated" (1979, p. 9). In this sense, the new generation of ethnobotanists openly condemned the imperialist motivations of Western science and defended indigenous epistemologies as valid avenues for knowledge production in rural Mexico. The counter-revolution was growing.

Framing the "Traditional": Unveiling the Counter-Revolution

As described so far, the fields of ethnobotany and agroecology were profoundly shaped in the 1970s and 1980s by the work of Hernández and by his background as an *agrónomo* converted into ethnobotanist. He stressed the recognition of campesino knowledge as a key alternative to the state's approach of modernising rural Mexico through industrial agriculture, which was expanded later by ethnobotanists like Caballero and Barrera. Thus, ethnobotany – and

interlinked fields such as agroecology – pushed for a countermovement or counter-revolution to the state-led GR rural approach. Mexican scientists propelled a national-scientific endeavour based on the revalorisation of Mexico's ethnic and cultural diversity, a political project where researchers acted as mediators between different institutions and local populations, and between traditional and scientific knowledge. In this section, I will explore the ways in which these ethnobotanists imagined, celebrated, and constructed the traditional and with it, how they framed women's knowledge and livelihoods – and how this impacted chile research and conservation.

By the 1970s, the field of ethnobotany in Mexico was being regarded as an intellectual and material bridge between "the peasant and the gardener, the *agrónomo*, the ethnobotanist, the biochemist, the geneticist and the plant breeder" (Hernández Xolocotzi, 1970, p. 10). The inclusion of culture, as being vital for the evolution and diversification of species, allowed for a consideration of plants as having different values and importance to social groups. That is, explaining the diverse cultural values attached to plants in local settings, their uses and techniques, paired with a non-utilitarian valorisation that became essential for the profession, ethnobotanists collaborated with, and served, these same communities (Hernández Xolocotzi et al., 1979, p. 3).

The revalorisation of local and indigenous traditional knowledge became a pivotal element in the foundational turn of the discipline. In this respect, unlike previous ethnobotanical studies, farmers and peasants received credit and agency for the diversification, domestication, and conservation of crop species. Local markets, regional plantations, and home gardens and parcels started to be conceptualised as the "biggest germplasm banks", in comparison to institutionalised seed banks (Hernández Xolocotzi, 1970, p. 9). Ethnobotanists celebrated peasant agriculture as a sign of resilience against centuries of colonial oppression and violence (Caballero, 1979; Hernández Xolocotxi, 1970; Zizumbo & Colunga, 1982). As Hernández Xolocotzi stated: "It is easy for us to classify them as ignorant, obviating the affection, the meditation, the creative effort that they have invested in the domesticating process of plants and in the same process of agricultural science" (1970, p. 15). In this sense, local knowledge and techniques were revalorised and reframed as valid knowledge.

But what did traditional mean to these scientists? In "*Agroecosistemas de México*", which is considered one of the founding works of Mexican Agroecology and edited by Efraím Hernández Xolocotzi, several emerging scientists agreed on the importance of recognizing traditional agricultural techniques as elemental to the process of crop diversification and conservation and highlighted their necessary incorporation into agricultural studies to improve the country's rural sector (Hernández Xolocotzi, 1981). Although the term traditional was not unanimously defined, Joaquín Ortíz Cereceres, *agrónomo* at the Postgraduate College, argued that "There is a great diversity of traditional agro-systems, which are the result of biological, ecological and cultural interrelationships, and of the evolution of these interrelationships, which has allowed the definition and stabilisation of those that optimise the use of the factors of the ecosystem in relation to anthropocentric needs....some are highly efficient and reach levels of productivity, which in many cases equal or exceed 'modern' production systems" (1981, p. 278). In the same text, Hernández and Ramos framed traditional as "the series of practices and cultural elements, not originated by modern mechanisms of science and technology, that serve as the basis for the use of natural resources by our rural population in almost all of our territory and that together we have called traditional agricultural technology" (1981, p. 321). According to these scholars, the historical links between indigenous cultures, land, and resource management resulted in a set of diverse agricultural practices and techniques – ones not related to modern science and technology.

Most Mexican ethnobotanical works in this period imply that the traditional is that which originated in pre-Hispanic times, which can be embodied in practices, epistemologies, habits, rituals, oral stories, or ways of understanding the world, that in one way or another survived until contemporary days. Although some authors acknowledged the fact that traditional does not refer to a static or immutable essence (Hernández Xolocotzi & Ramos, 1981; Niño Velazquez, 1981), most used the dichotomy with modern agricultural science and sometimes framed both concepts as a contrast, a trend that would linger in the literature well until the 1990s.

For example, Leobardo Jimenez Sanchez, Hernandez's student at Chapingo, associated traditional agricultural knowledge with the temporal flow of cultural processes as it relates

through time to the "security and hope of peasant groups in the geography and history of Mexico, which in turn has seen the birth and growth of modern agriculture, with which to compare" (1981, p. xxiii). By explaining how traditional agriculture is more widely extended in the country than modern agriculture (found in more concentrated patches), he then continued to assert that both types of agriculture "are configured, coexist and at the same time differ and contrast in the national territory" (1981, p. xxiii). By doing this, ethnobotanical and agroecological researchers emphasised their role in appreciating and describing the traditional as an alternative path to industrial agriculture.

Contrast with the modern came to signify a departure from "Green Revolutionary" approaches to food security, crop improvement and rural development; and also, a way of rendering visible the negative consequences of the latter, both socially and ecologically. Whilst ethnobotanical scientists declared their disciplinary standing point as a counterforce to the GR ideology, they served also as intermediary agents, since most held posts in academic or state institutions. Therefore, as both approaches pushed for development, ethnobotanists and agroecologists highlighted the socio-political context of agricultural settings as essential to attain just and environmentally friendly production and conservation systems. In a way, they thought of their profession as the path to understand and then apply traditional knowledge for a generalised rural development (Gómez-Pompa, 1993; Gómez-Pompa & Kaus, 1999) in contrast with modernising initiatives, such as the GR, which focused on *agricultural* development (Ellis and Biggs, 2001).

Yet, it is important to recognise that even if they countered the GR-led ideology, this cohort of Mexican ethnobotanists also worked through it and at certain points, with it. For example, many authors mention the necessity to conserve crop varieties primarily for improvement, signalling crossings with agricultural science. Hernández himself was an *agrónomo*, and many worked in the same institutions or universities. More so, by describing the traditional as a contrasting designation – even if positive – to the modern agricultural techniques of industrialised agriculture, the communities that embraced these practices were not part of "modern" Mexican society, as many plant breeders and politicians openly stated in this period. Scientists speculated, based on "agroecosystems analysis", that traditional systems would inevitably go through a remodelling process to comply with changing social

necessities (Jiménez Sánchez, 1981, p. xxvii). In a similar line, others pushed for the incorporation of modern technology into traditional technology, with the former eventually becoming "traditional technology" itself (Niño Velazquez, 1981, p. 153). This implies, in a way, that the "traditional" would have to become "modern" at some point and integrate to Western science – with ethnobotanists and agroecologists as the link between both spheres.

It is worth reflecting then on how the emergence of the conceptualisation of traditional agricultural knowledge in this field and period shaped ethnobotany in Mexico in a unique way. The counter-revolution not only meant a departure from a GR model in agriculture, such as the technification or industrialisation of production. It also allowed for critical views about Western science as the sole way of creating valid knowledge. Hernández clearly summarised this back in 1970: "This group of farmers has been facing the most difficult problem of agricultural research and in reality, we have failed by not learning much more from their knowledge.... In more advanced countries they may laugh but let us not forget that their progress and our battle against the scarcity of corn, springs from the cultural roots of these people" (1970, p. 15). However, Hernández also described science as "the most powerful process available to man and for the acquisition of knowledge" (1985, p. 3). Along with their own celebrations and contradictions, these ethnobotanists built a specific identity and meaning from their role as mediators of the "traditional" and the "modern". They set themselves as defenders and contributors of the former – and as a bridge between both worlds.

Chile and Women in Traditional Agricultural Knowledge

The role and importance of chile in these early studies is acknowledged but marginalised throughout the 1970s and 1980s. As I speculate, the research and political priorities of ethnobotanists and agroecologists remained focused on forwarding a departure from the modality of industrial agriculture. The biggest challenge for these scientists was figuring out how to formulate a bridge between traditional epistemologies and modern science, whilst critically advancing solutions for the consequences of capitalist agrarian policies, inequality, and loss. In this sense, chile was valued as an integral part of indigenous or local management

systems, which, in their own holistic nature (of being multi-factorial and multi-species), promised to go beyond the *agrónomos´* single species ecosystems (Jiménez Osornio & Gomez-Pompa, 1991) or the study of "monocrops", so to speak.

In a way, ethnobotanists and agroecologists envisioned the union of the "traditional" and the "modern" by reframing local practices and applying their social values in a national context (Gomez-Pompa & Kaus, 1999). Their findings served as a possible answer to ongoing genetic erosion of biodiversity and environmental destruction. Within this research context, chile occupied a significant yet peculiar place: it was the undeniable giver of flavour in Mesoamerican diets, and similar to INIFAP *agrónomos'* case, was represented as a "basic" crop in terms of flavour and culture but still not as important as a maize or beans.

In fact, one of the first ethnobotanists to acknowledge the role of chile in local cultures was Hernández Xolocotzi. In his "Ethnobotanical Notes", he stated that Mexicans are accustomed to eating spicy plates, and that therefore, from the ethnobotanical point of view, it is pertinent to think about the reasons why chile was included in indigenous diets and thus, domesticated (1970, p. 28). He concluded, with gusto, that chile breaks the monotony of an otherwise simple combination of tortillas and beans:

> "By having chile, there is no such monotony!...The enumeration of forms and uses of hot peppers in Mexico is extensive, reaching the most refined uses of the mole poblano and the black mole of the Zapotecs. For me, the selective motivation originated from the monotonous diet of our indigenous groups and the ability of chile and its various forms to stimulate the palate and cover up the monotony of tortillas, tamales, tacos, etc. and anyway, corn and corn…" (1970, p. 30).

Further studies in the 1980s also present chile as a conspicuous element in local diets. For example, Caballero & Mapes (1985, p. 34) denote the use of chile in their famous study of plant collection practices in the Purépecha culture, where chiles are commonly cooked with collected fungi or *quelites* (herbaceous species that are consumed and cooked as vegetables). In the same way, relevant works such as Gómez-Pompa (1987, p. 9), Zizumbo and Colunga (1982, p. 230), and Casas and colleagues (1987, p. 318), mention chile as part of the Mayan,

Huave, and Mixtec production systems and diets, mainly when describing systems like *milpas* or home gardens.

Therefore, the role of cuisine and flavour was indeed present and considered by these scientists. Actually, Hernández Xolocotzi included the following questions as part of an outline for ethnobotanical research that would define the field for at least two decades: "What relationships are generated between food preparation processes and the amplitude and intensity in the use of resources? What interrelationships are found between food resources and the characteristics of individuals and the socio-economic organisation?" (1979, p. 7). One might think that these questions and the recognition of chile as flavour-giver would bring about an interest to study culinary traditions and more specifically, the role of women (as they, generally, are those who prepare, cook, and manage the household's food resources in many contexts in Mexico and in the world) in domesticating and conserving landraces.

By portraying the relationship of ethnobotany as one that worked with local knowledge and agricultural *techniques*, early ethnobotanical and agroecological works gave lopsided attention to male *agricultores* or farmers that worked directly on the land, or to social interactions more generally, as the main responsible agents for the domestication, diversification, and conservation of plants. Texts, articles and books on ethnobotany or agroecology from this period mainly touch on traditional knowledge as drawn by peasant men (Hernández Xolocotzi, 1970; Hernández Xolocotzi, 1981; Hernández Xolocotzi & Alanis Flores, 1970). In this sense, the framing of women as secondary actors in traditional agricultural knowledge might add an important insight into why a crop so relevant as chile was side-lined beyond the scientists' priority of studying agricultural systems "as a whole".

It is important to note that the counter-revolution in ethnobotany and agroecology was defined by a particular set of actors: men with strong educational backgrounds in academia. Most of them held degrees in either biology or agricultural science from universities like UNAM, the National School of Agriculture (ENA) – then the University of Chapingo (UACh) –, or even from the United States, such as the case of Hernández Xolocotzi, who studied at Cornell University and Harvard University. Considering that the first woman to ever study at the Universidad de Chapingo enrolled in 1967 (Caire-Pérez, 2016), it is

plausible that most researchers overlooked the role of women in their professional environment, but also in their fieldwork.

The active agency of women is not present in the texts because the agricultural *field* and the *production techniques* were the central focus. Ironically, the role of flavour and culinary uses of crops were identified by ethnobotanists as elements of diversification and conservation but left at that. When briefly mentioned, as by Hernández Xolocotzi in 1979 (p. 7), the relationship between food preparation and natural resource management, as well as the interrelations between alimentary resources and socio-economic organisation, came to be considered as "key ethnobotanical research questions". Yet, these "key" questions would not be addressed until much later.

Despite a general neglect in this literature, women are present in men-centred discussions of agriculture. For example, in 1970 Hernández Xolocotzi and Alanís Flores held that "The indigenous farmer [*el agricultor*], forced by the need to maintain types of corn with better adaptation to the ecological niches of its cultivation and to preserve culinary characteristics related to the form of its regional consumption, has favoured the break of the continuum corresponding to a panmictic population" (p. 3). In this sense, flavour is described as a factor that shaped crops' diversity, which was encouraged by the monotony of diets and regional taste preferences (Hernández Xolocotzi & Alanís Flores, 1970, p. 28). Even this important culinary perpetuation of crops was adjudged to "*el agricultor*", as the one that selected and maintained varieties with specific culinary characteristics dependent on the modes of consumption (1970, p. 25).

Moreover, Hernández Xolocotzi stated "For me, the most convincing measure of a good gardener, a good farmer, a good agronomist, is *his* ability to provide the most favourable environment for the desired development when cultivating… despite his ordeal with the spread of Western culture – persecution, displacement, violence against *his* culture, kidnapping of *his women,* death" [emphasis added] (1970, p. 15). Further on, he repeatedly described men's agency in domesticating landraces (1970, p. 16). Even if "man", "he", and "his" are used as general pronouns in Spanish, I argue that these texts refer to male peasants and farmers, since the discussion specifies men and not women as the main agents and carriers of traditional agricultural knowledge. A supporting proof is that women *campesinas*

are mentioned (explicitly in feminine) when describing the family unit or in female-related activities.

The conceptualisation of the family came to be built as the centre of peasant subsistence production and its analysis (Hernández & Ramos, 1981). With respect to this, Leobardo Jiménez Sanchez, established that "… the rural family, as the central unit of society, whatever its magnitude, geographical location and economic possibilities, should be recipients of the benefits of the development that it promotes through its work, of the use of the natural resources that possesses, of the application of the available scientific elements and of the support of the agricultural services that the State has to put at its disposal…" (p. xxii). He then stated that social and economic aspects such as "the consequences of increasing production, aspects such as family organisation, the potential of the family, the role of *campesinas* in improving the community…etc." are fundamental to understanding traditional agricultural systems of production (1981, p. xxvii). Women, then, are mostly framed under a joint role in family or community, and not as individual participants and creators of agricultural knowledge.

In addition, women appear in these early revolutionary ethnobotanical texts as either attached to other actors or limited to certain spaces. For example, Hernández Xolocotzi, Jorge Montes, and Teodoro Gómez acknowledge women's plant knowledge in house gardens (1975, p. 14). In the same volume, they mention housewives as middle-class buyers and to *campesinas* or *intermediarias* (intermediary or trader in feminine) as women that sell their harvest and products on a local market (1975, p. 6). While describing markets as important ethnobotanical spaces of study, Hernández Xolocotzi denoted the interest of housewives in buying and comparing the best prices they can find (not *campesinas*, as they are generally related to a lower social status). In this sense, gendered roles applied to both *campesinos* and *campesinas* in different ways. The recognition of women, although seldom, was narrowed to selling products or being part of the family unit. Men, on the other hand, were the carriers and promoters of traditional agriculture.

One possible response to this gendered explanation is that the rural context prevented male ethnobotanists from engaging with women and their knowledge. In other words, *access* rather than oversight determined the overrepresentation of men in agriculture

in the literature. Indeed, factors like language, patriarchy, and the norms governing social spaces could have influenced their visibility in ethnobotanical research. Even when considering all these factors, the scientists' discourse suggests more than a lack of observation.

First, as mentioned above, ethnobotanists explicitly mention the role of cuisine and flavour as important for crop domestication and diversification – which denoted a recognition, even if superficial, of spaces such as the kitchen and the house in knowledge-making. Also, these same scientists framed markets as important places of research, where many women worked as crop vendors (in fact, often selling chiles). Contact at the market, outside the household, was an acceptable public sphere of interaction. If the role of *campesinas* had been considered, but scientists were unable to engage with them, this detail could have been stated in the work, but it is not. In this sense, chiles, as crops that grow in house-gardens, usually situated next to kitchens, and mainly handled by women, might have been neglected not only because they were "part of agriculture systems as a whole" but also because there was an existent gender bias.

Indeed, the absence of women's agency is visible beyond the research. Whilst referring to professional actors, Hernández Xocolotzi and colleagues define "the sociologist", "the economist", and finally "the ethnobotanist", as masculine nouns (1975, p. 6). As Leobardo Jiménez Sánchez expressed about the systematic study of México's agricultural situation "this effort undoubtedly requires *men* trained to investigate, organise knowledge, systematise it, teach it and continue with the process of generating it through research that must return to its point of origin: the individual, the family, the community, the region, the country" [emphasis added] (1981, p. xxv). Therefore, it is clear from this case that social perceptions significantly shaped how women would become part of – or not – ethnobotanical studies on traditional agricultural knowledge from this period. With this, I do not state that ethnobotanists in the 1970s and 1980s were *wrong*. Rather, ethnobotanical research in this context was gendered and hierarchical. As a result, women's spaces and knowledge were invisible to these researchers. This means that places such as kitchens, and culinary knowledge were obviated, alongside their role in the conservation of crops like chile.

This, however, would begin to change in the following decade. As the biological and environmental sciences shifted towards the sustainability agenda, the counter-revolution within ethnobotany and agroecology veered towards a renewed conceptualisation of the modern and the traditional. With the growth of interdisciplinary approaches, the link between cultural and biological diversity would solidify in the foundations of ethnobotany, agroecology, and ethnoecology – a closely related area with special focus on ecosystems. Within these fields, food systems and crop conservation would be a priority, especially the repositioning of food security and sovereignty, and the implementation of *in situ* conservation strategies. These changes would forward new visibility for women and chile in research in the dawn of the following century.

Bridging the Modern and the Traditional: Towards Sustainability and Food Sovereignty

Even though feminist studies had been well-established globally since the 1970s, the inclusion of women's role in agriculture, food systems, and biodiversity, started to materialise only in the 1990s in ethnobotany and agroecology, as well as in areas like ethnoecology, rural studies, and environmental studies more broadly (Iriarte et al., 1999; Meares, 1997; Quiroz, 1994; Rimarachin Cabrera, 1997; Rocheleau, 1995). In Mexican ethnobotany and agroecology, however, an explicit incorporation of gender would not be widespread until the following century.[2] Curiously, this timing coincided with a significant increase in ethnobotanical chile studies, which mostly centred on exploring the importance of cultural practices – such as culinary traditions – in the diversification and conservation of chile.

This fact, however, did not mean that ethnobotany and agroecology's trajectory remained unchanged during the 1990s, nor that chile's absence in these fields prevailed. Ground-breaking world events such as the dominance of neoliberal policies, the imminent climate crisis, an ever-growing social disparity, and the degradation of natural resources bolstered calls for a sustainability agenda, environmental justice, and the transformation of

[2] Even when gender perspectives would not be evident in ethnobotany and agroecology until a decade later, they would be present in wider national discourses and, very importantly, in agrarian, student, urban and rural, and union movements (Stephen 1998).

food systems (CBD, 1992; Via Campesina, 1996). In Mexico, the implementation of NAFTA resulted in the mobilisation of campesino and indigenous movements that called for territorial, cultural, and production rights, such as the Zapatista Army of National Liberation (EZLN) in 1995, Chiapas, Southern Mexico.[3]

These changes would reinforce the realisation that, in order to conserve genetic resources, and to achieve environmental justice and equitable food systems, the link between cultural and biological diversity had to be further comprehended, acknowledged, and explored. This propelled further integration of the social sciences into the biological and environmental sciences, and into food studies and policy.

Under this context, ethnoecology emerged in the 1990s as an important avenue for conceptualising sustainability in the management of natural resources. Closely related to ethnobotany and agroecology, ethnoecology developed as an interdisciplinary effort that explored the relationship between the natural world and humans. The field acknowledged local and indigenous cultures and the multiple and plural ways in which they inhabit, know, and manage their ecosystems (Nazarea, 1999). With this knowledge, scholars promoted the study of TEK as a means for socio-environmentally just strategies in the use of natural resources (Haenn, 1999; Hunn, 1993; Nazarea et al., 1998; Williams & Muchena, 1991).

In Mexico, ethnoecology became mainly represented by Victor Toledo, celebrated biologist and later Secretary of Environment, whose work was dedicated to bridging the biological and cultural dimensions of diversity and ecosystems, as well as to the defence of indigenous cultures and their territories. This resulted in what he later proposed as the triad of "kosmos" or beliefs, "corpus" or systems of knowledge, and "praxis" or practices (Alcarcón-Cháires & Toledo, 2003). Through this methodology, he aimed at "interpreting the models of the natural world that peasants, families and communities have in traditional cultures, with the goal of comprehending local knowledge in all its entirety" (2003, p. 7). Toledo's extensive work was essential for the conceptualisation and implementation of the later terms biocultural diversity and biocultural heritage in policy and in conservation strategies.

[3] The EZLN, for one, pushed for a renewed integration of women in the organisation of community life, including food production and territorial rights (Bellamy, 2021).

As such, Mexican ethnobotanical, agroecological and ethnoecological projects of this period started to re-frame the dichotomy of modern-traditional agriculture and the conservation strategies that followed from it. Of course, this was not a new topic in the fields: the conservation of genetic resources, and the study of crop diversity, were stated as some of the main objectives of ethnobotany since its early revolutionary years (Hernández Xolocotzi, 1970). Ethnobotanists and agroecologists had long voiced the importance of recognising and preserving the enormous array of local crop varieties scattered around the country. Yet, these scientists deepened their engagement with the topic of biological conservation by aligning their rhetoric with the emphasis on sustainable development, which was growing exponentially in the international arena (Toledo & Moguel, 1996).

Scholars from these areas started to look past the contrasting and essentialising use of "modern" and "traditional" to envision a wider perspective for agricultural development. They did not stop using these paradigmatic terms, but rather framed them differently. For example, Marco Vásquez Dávila, ethnoecologist and later chile expert, argued for a "modernity" paired with plurality; a national setting with a pluricultural approach that transforms the relationship between society and nature (1992). Casas, Viveros, and Caballero added to this discussion by framing the union of traditional knowledge and scientific and technological knowledge as the key to developing new and better strategies for natural resource management in Mexico (1994, p. 19).

Likewise, acclaimed crop conservation biologist Mauricio Bellon expanded on the more complex relationship between the campesino agriculture and agro-industrial technologies by noting the rural mosaics arising between them (1996). In a similar fashion, renowned agroecologist Gomez-Pompa and ecologist Kaus described ethnobotany's aim to understand pre-Hispanic botanic science, and the need of conciliating national policy with local empirical knowledge, since "neither by itself is enough" (1999, p. 5984) for attaining proper results in conservation efforts. Finally, with respect to sustainable development, Toledo and colleagues stated that "this term allows us to visualise a third alternative to the almost eternal dilemma between 'tradition' and 'modernity' within a process of 'post-modernization', where Mexico and Latin America transcend the walls of the academic world to reach the political discourse and actions of many agrarian social movements" (1998, p. 70).

In this sense, the attention given to sustainable agriculture systems materialised in two main avenues: calls for *in situ* crop conservation and for the repositioning of food systems.

The rising interest in *in situ* management of crops led to an increased interest in studying specific crops in their given ecological habitat. This shift complemented the existing focus on analysing the place-specific relationships between humans, their cultures, plants, animals, and the environment. This intellectual and theoretical trend drew attention to chile, which had largely diversified in Mexican territory. One of the first chile-centred ethnoecological studies was that of Marco Vásquez Dávila, who explored the intricate link between wild chiles, birds, and indigenous communities. Vásquez Dávila studied how the Chontales from Tabasco, Southeast Mexico, identified the dispersal of wild *chiltepines* or chile *amash* (*Capsicum annuum* var. *glabriusculum*) by the *pistoqué* (or *ts'iia* in Chontal) bird (1997). Both the fruits and leaves of chile *amash* were intrinsic components of local dishes such as *pozol* (corn-based drink), green pork, and turtle or *tortuga*. He explained that Chontales have a deep knowledge of both bird and chiles, and that they recognise *pistoque´*s characteristic song, which resembles the word *iich* or chile in Chontal language (Figure 3.1). When seen in home gardens or *milpas*, these birds were respected and left alone, even when some birds ate the chiles from the family garden. Sometimes, Vásquez Dávila noted, some chiles were left in the *chilera* for the birds to eat and then to disperse the seeds. Yet, the same plants were protected from other animals.

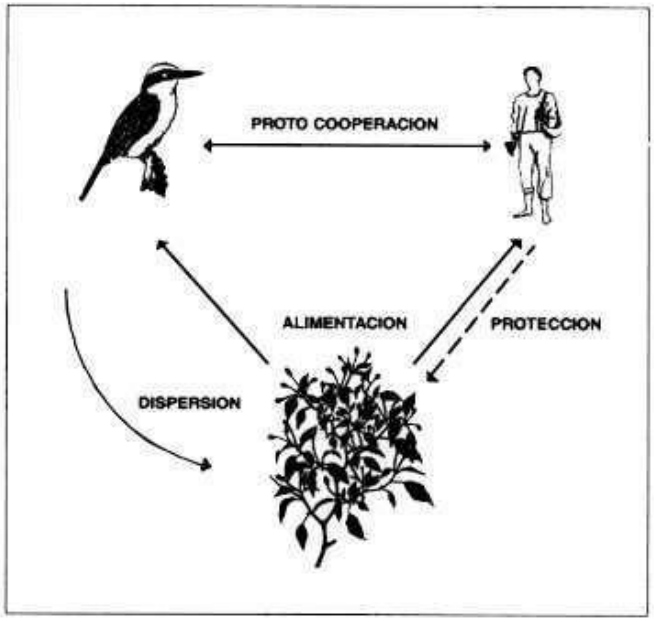

Figura 1. Dispersión de *Capsicum annuum* var. *glabriusculum* por el pistoqué *Pitangus sulphuratus* explicada por los chontales de Tabasco, México.

Figure 3.1 *Ecological relationships between the Chontales, pistoqué, and chile amash (Vázquez Dávila, 1997).*

In line with the surging attention to *in situ* crop conservation efforts, American ethnobotanist Gary Nabhan, who from the 1980s worked on seed and landrace conservation (1985), started to study the *in situ* management of wild *chiltepines*, one of the most spicy chiles in the world. His early chile research took place in Aridoamerica, a biologically diverse area extending from Northwest Mexico (mostly Sonora) to Southeast US (Arizona). Nabhan and colleagues explained that while most funds were being funnelled to *ex situ* conservation, wild congeners – such as these chiles – must be protected *in situ* considering the interactions they need for survival (Tewksbury et al., 1997). This is because chiles like these are not like domesticated ones: they grow wild berry plants in the desert and not on cultivation plots. As such, conserving these populations meant conserving the whole ecological setting, which included the territory, the birds, and the nursing plants. Nabhan and colleagues emphatically warned against human exploitation since many populations disappeared from overharvesting and further commercialisation of the chile fruits. As such, even priority was given to the conservation of these chiles for "potential genetic resources for crop improvement" (1997, p.

99), Nabhan and colleagues suggested that it was necessary to implement both *ex situ* and *in situ* strategies to ensure the survival of *chiltepines* in the region (1991, 1997). For the subsequent three decades, Nabhan continued working with chile diversity in Mexico and the US.

In this sense, calls for sustainable food systems fed into chile research during the 1990s. With growing attention to *in situ* conservation in ethnobotanical, agroecological and ethnoecological research, chile-centred studies slowly started to emerge, not only in Mexico but also in the international scene. Nationally, scientists pushed for the creation of mixed *in situ* and *ex situ* state-led initiatives, which eventually materialised in the creation of the National System of Plant Genetic Resources for Food and Agriculture (SINAREFI) in 2002. Even when chile-specific studies and conservation efforts remained scarce until the 21st century, the emergence of global efforts on re-thinking global food systems pushed for attention to a crop ubiquitous to most traditional agricultural systems in Mexico. Within this ideological re-framing, biologists also questioned mainstream and institutional standards on diet and nutrition – where chile had a peculiar place as a flavour-giver but non-caloric crop.

Chile and Diet: Analysing the Relationship Between Plants, Culture, and Food

Alongside the repositioning of conservation strategies and the goal of pursuing sustainable food production systems in the 1990s, ethnobotanical, agroecological and ethnoecological studies in Mexico sought to understand how local crops were consumed, along with their cultivation and production. This also weaved into parallel discussions and worries about food security and local diets. It was clear from early criticisms of the Green Revolution in the 1970s and 1980s that monocrop production systems and agroindustry were not a straightforward solution to famine. In Mexico, this paired with growing levels of grain importations, especially that of corn, the most important staple crop in the country. This was accompanied by a growing commodification of foodstuffs, which accelerated the consumption of saturated fats and processed foods (Gálvez, 2018). These self-sufficiency and health crises, alongside the rise of food sovereignty movements, permeated the work of this generation of

ethnobotanists, agroecologists, and ethnoecologists. It became evident that a transformation of thought around food systems had to be implemented.

For one, scholars in these fields criticised the state and international approach on food aid and security, which followed the guidance of international organisations such as FAO and the World Health Organisation (WHO). The criticisms centred on the futility of several aid programmes that bypassed situated food production and local dietary preferences. For example, in their iconic book of Mixtec agricultural systems in the mountains of Guerrero, Casas, Viveros and Caballero state:

> "In the last years of the 1980s, FAO, through the National Indigenous Institute (INI), and the Program for the Integral Development of Family (DIF), promoted food assistance programs in the Mountain region. These programs, however, have been isolated efforts, which have not had continuity. On the other hand, these programs promote the consumption of foods with little or no cultural acceptance, or else, unviable for the infrastructure conditions of the region. For example, in the 1987 FAO programs, pantries containing cheese (with refrigeration requirement), cans of chicken curry, and powdered milk were included. Their appearance and flavour were not to the taste of the peasants, who preferred to give them to the animals" (1994, p. 227).

Such findings were a call to action for researchers in Mexico. Ethnobotanical, ethnoecological, and agroecological studies started to forge a connection between nutrition, local diets, peasant production, and culturally appropriate foods. As such, scholars Alejandro Casas and Javier Caballero, both from UNAM, began to pave the way for studies that encompassed in detail the consumption and nutritional aspects of crop diversity in different cultures.

In doing so, they set their own parameters of what basic crops or foodstuffs meant. For example, these ethnobotanists defined basic food as "one that is consumed on a daily basis and that constitutes the essential part of one or all daily meals throughout the year" (Casas et al., 1994, p. 208). The latter came to include any type of crop or foodstuff that was

part of the daily consumption of a given community or group, not only grains or other typical staples. More so, the context-specific studies that these scientists undertook on agricultural production and dietary habits highlighted how their fields were vital to rightfully evaluate the nutritional state of the population, and the potential strategies to improve it. This is important because they framed a foodstuff or crop as "basic" under a local or regional scope, not a generalising category such as that used by plant breeders or the government's food assistance programmes. For example, as Casas and colleagues (1994) described, in the case of the Mixtecs of Guerrero, diets were deemed deficient if analysed only through the consumption of grain crops. However, when cultural traditions were considered – such as the collection of specific wild and weed plant species, which added fibre and vitamins to the diet – nutritional values improved significantly.

Therefore, their conceptualisation of "basic" departed from, for example, INIFAP's plant breeding agricultural categories, based on industrial production and under a market perspective. INIFAP's classification of basic was intrinsically related to staples (high in energy and nutrients such as grains or legumes) rather than as an essential in terms of habitude, availability, and culture preference. In fact, INIFAP's section for vegetables and fruits was mostly dedicated to export crops. As discussed in the last chapter, plant breeders in the 1970s and 1980s named chile *basic* in terms of cultural identity, but not for agricultural production. This means that in their research chile was more linked to a crop waiting to be improved for promising national and international markets.

In contrast, from the late 1980s onward, chile was considered a *primary* or *basic* dietary source along the other *milpa* components such as maize, beans, and sometimes squash in ethnobotanical, ethnoecological, and agroecological studies. That is, chile was framed as one of the main and most important components of Mesoamerican diets and not only a monotony-breaker. For one, Casas, Viveros, and Caballero argued that the main elements of the Mixtec food pattern are maize, beans, squash, and chile (especially chile *guajillo*), produced for self-consumption, and that these crops served as the basis for subsistence along wild species obtained from collecting, hunting, and fishing (1994, p. 206).

Additionally, Casas and Caballero mentioned that "at present, the Mexican rural indigenous population bases its subsistence on agriculture, mainly on seasonal corn, beans

and chile; its basic foods" (1995, p. 37), which they further reinforce in their description of Nahua and Mixtec plant management in 1996. Similarly, Basurto, Martínez Alfaro and Villalobos remarked that in northern Puebla "Basic crops such as corn, beans, squash and chile, are generally managed as multiple crops in which plant species are temporarily associated concomitantly, interspersed or overlapping, with different patterns of spatial distribution" (1998, p. 49). In this sense, a crop that was generally thought of as a non-basic, commercial (or export) vegetable in other arenas, acquired the denomination of *basic* in ethnobotany, ethnoecology, and agroecology – linked to the analysis of situated dietary preferences.

These scholars, then, framed chile as an actual basic food for local food systems. As approaches on food security, insecurity, and hunger prioritised the development of improved staple or grain varieties (as in relation to caloric intake) before the 1970s, ethnobotanical researchers in the 1980s and 1990s came to realise the nutritional, cultural, and social importance of non-grain crops like chile through studies of multi-species campesino systems. For example, they recognised that "An analysis of the [Mixtec] eating patterns allows us to see that there is a very close relationship between diet and cultural factors, family economy and purchasing power in the market… Indeed, the diet of this population is basically made up of elements produced directly in agricultural activities (corn, beans, chile)" (1994, p. 213). In doing so, the scientists framed chile as a culturally appropriate ingredient and as a vital source of vitamin C, calcium, iron, retinol, niacin, and riboflavin (Casas et al., 1994, p. 210). Here, caloric intake was neither *the* sole measure for defining basic foodstuffs nor the main arbiter for quality of diets.

In this sense, ethnobotanists, ethnoecologsists, and agroecologists framed chile as omnipresent in local diets, but also as a flavour-giver, a wild-collection plant, a condiment in home gardens, as a component of *milpas*, and as a source of vitamins. This rendered chile a basic crop, and a very important one, for Mexican traditional cultures and diets. Chile, however, was not directly approached nor deepened in their studies. This is partly explained by the fact that chile inhabited too many spaces at once (the field, the house garden, the kitchen, the market) without being necessarily caloric (indispensable for survival). Therefore, chile's versatility might have placed this crop in an ambiguous place with respect to the

period's ethnobotanical, agroecological, and ethnoecological research. Chile was rendered both vital and conspicuous – but still not exhaustively explored.

Yet, despite the lack of chile-specific studies in ethnobotanical, ethnoecological, and agroecological research, reflecting on how this crop was framed in this period is helpful to complicate the historical understanding of the evolution of the terms food security and food sovereignty. Even when the concept of food security started to be used in Mexican agricultural policy until the 1980s, state projects directed to food distribution, malnutrition, and hunger, were based on nutritional references and recommendations established by the FAO (Luiselli, 2017), a trend that continues until the present day. In 1974, after the World Food Summit, the concept of food security was consolidated under the auspices of FAO, where the initial approach was centred on "volume and stability of food supplies" (FAO, 2003, p. 25). During the 1980s and 1990s, the limitations of food security as based on "calories" and "supply" became visible, especially in developing countries where food systems showed the clear segregation of peasant communities and the ever-increasing inequalities in a liberalised production system. Therefore, by the mid-1990s revised definitions of the concept started to integrate dimensions such as quality of life, social and economic access to food in marginalised groups, nutritional balance, and even food preferences (FAO, 2003, p. 25).

Most food security programmes led by the government throughout the 1980s and 1990s aimed at the distribution and subsidy of "basic" foods, which in this context meant grains and staples, and protein products such as powdered milk and eggs. This was clearly shown in the creation of the "*canasta básica*" or "basic basket", a standardised list of essential foods implemented by the Mexican Alimentary System in 1980, with the purpose of satisfying the vital needs of families holding the minimum wage (Luiselli, 2017). The *canasta básica,* as a measure of the minimum requirements for nutrition and calories (still in use today albeit with some additions), included subsidised products like maize, wheat, rice, beans, potatoes, meat, eggs, milk, industrialised ones like cookies or canned food, and the main vegetables consumed in Mexico such as tomatoes, onions, and interestingly, chile (mainly canned). Even as chile was considered a part of this programme, this "basket" was still a generalised and homogenising approach to Mexican diet diversity, as it was negotiated in terms of the national food industry (Martínez Rivera, 2009). Broadly speaking, state food security

programmes were based on caloric input and supply rather than on encouraging localised production and access to regional crops or ingredients: exactly the opposite of what ethnobotanists emphasised. Therefore, I argue that the "basic-ness" of chile included in food security state projects throughout the 1980s and 1990s remained closer to the category used by plant breeders at INIFAP; chile as a symbol of the Mexican diet but under a market-based and industrial frame.

In this sense, despite the inclusion of chile in the "*canasta básica*", the evolution of the term "food security" was not directly proportional with the on-the-ground application of these theoretical additions. As cited above, Casas and colleagues described how the FAO, in conjunction with the National Indigenous Institute (INI) and the Program for the Integral Development of Family (DIF), directed food programmes with poor consideration to cultural appropriate foodstuffs and local preferences in a Mixtec region of the mountains of Guerrero (1994, p. 227). Their focus remained a universalised ideal of calories and supply. These ethnobotanists signaled that "these experiences reveal the importance of why food assistance programmes should be constant and with foodstuffs with greater demand [from the local population]: maize, beans, *chile*, eggs, and meat" (1994, p. 227). In addition, they highlight "the results of this investigation suggest the possibility to include a wide range of vegetable resources of the area, for which there is already a tradition of consumption" (1994, p. 227). Thus, ethnobotanists offered another approach to food security insofar they highlighted the importance of local availability, production, tradition, and preference. Chile here represents the flavour, condiment, and vitamin source of the Mixtec diet, not an all-encompassing chile for the whole of Mexico.

In this sense, this group of biologists pushed for the development of parallel conceptualisations of crop use, nutrition, biodiversity, local contexts, and food sufficiency and security, outside the mainstream institutions of FAO, WHO, GR-related institutions like CIMMYT, and of more state-nationalistic approaches, like INIFAP and other food programmes. That is, they questioned the standardised version of agricultural production and food security and formulated an idea of adequate nutrition and traditional value of their own field-based observations. They criticised generalist food assistance projects and underlined the importance of local self-sufficiency, production, and cultural preferences. By linking local

production systems to cultures and plants, these scientific fieldworkers situated themselves as supporters of what became the food sovereignty movement throughout this decade. This shows how the limitations of food security as a generalisable caloric model resonated in certain scholar approaches.

As the country underwent the decrease – and ultimately the loss – of self-sufficiency in maize (Luiselli, 2017) through these three decades, I speculate that chile was not essential enough to attract significant state research funds. Even as scholars framed chile as vital for Mesoamerican diets, it was not perceived as being in any danger, especially in contrast to more immediate problems with maize, and to the increasing commodification and access to processed foods (Pilcher, 2017). In fact, chile production satisfied national demand, and was a burgeoning export product. In this sense, chile was not a central focus of study because the crop – considered ubiquitous but local – occupied so many categories: vegetable (or *hortaliza*), condiment, wild crop, domesticated crop, *milpa,* key national symbol, and more. Plus, no apparent risk of loss threatened its existence. Chiles were found in every home-garden, in every *tianguis* (local markets), and in all markets (small and urban) and later in supermarkets.

Ultimately, the historical analysis of chile in these fields through the 1970s and 1990s is significant for two main reasons. First, thinking about how ethnobotanists and agroecologists framed traditional agricultural knowledge in Mexico with a gender perspective can help us reflect how and why chiles and women were overlooked. Second, the history of chile's place in ethnobotany, ethnoecology, and agroecology in Mexico shows how a crop's value can be both celebrated and ignored in different ways through time. For ethnobotanists and agroecologists, chile's basic-ness was centred on its presence in most traditional systems and local diets. In time, chile's link to flavour, nutritional qualities, and cultural preference, rendered this crop essential for questioning the paternalistic and homogenising approach of food programmes and policy. This opens an avenue of historical research by considering how research groups outside Western-dominated international organisations defended the inclusion of culturally adequate foods into aid and food security programs, along the need to address *campesino* and indigenous groups' marginalisation in agricultural and food production systems.

Chile's – and women's – invisibility, however, would soon change in ethnobotany and related areas in the turn of century alongside the inauguration of the National System of Plant Genetic Resources for Food and Agriculture (SINAREFI) and a flourishing interest in culinary patrimonies. Paradoxically, chile's role in food security programmes would remain contested, signalling the continuous influence of political agendas in food policy.

Chapter 4 : The Biocultural

By the early 2000s, the intellectual separation between biological and cultural diversity had been breached by academics and policymakers. The loss of human cultural traditions and biological genetic resources as part of one larger connected phenomenon was made explicit. The protection of diversity transcended the biological realm to encompass cultural factors such as languages, ethnicities, and local practices, all of which became solidified in the term "biocultural heritage" (Maffi, 2001; Sepkoski, 2020). This connection between biological and cultural diversity poured into academic and institutional conservation initiatives at the turn of the twentieth century and was widely diffused by the 2010s.

Aligning with this framework and responding to FAO's International Treaty on Plant Genetic Resources for Food and Agriculture (often called the Seed Treaty), signed in 2001, the Mexican government inaugurated the National System of Genetic Resources for Food and Agriculture (SINAREFI) in 2002. The Seed Treaty's guidelines for the attainment of food security followed the definition set at World Food Summit of 1996, which envisioned this as something that "exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life". In addition, the Seed Treaty underlined the "enormous contribution" of farmers in developing the world's wealth of plant genetic resources, alongside highlighting the importance of protecting their traditional knowledge and their right to benefit from the use of these resources (FAO, 2009).

Even if the concept of food security evolved to include cultural and context-dependent aspects such as food preferences by the 1990s, criticisms noted a continued failure of governments and international institutions to address more structural inequalities that underpin contemporary food systems. Several scholars such as Fenzi and Bonneuil (2016),

López Salazar and De la Torre Valdez (2022), Pasquier (2019), Rubio (2013, 2019), and Torres Salcido (2019) signalled that the widespread definition of food security underlines *access* as central to attain food security, without specifying if foods are locally produced or imported. More so, they argued the concept failed to challenge the overwhelming power held by transnational companies in controlling seeds and agrochemicals, the price volatility linked to free markets, and the embedded neglect of small farmers and peasants under capitalist agriculture systems. These critiques have been especially pertinent in Mexico, where a neoliberal economic model was pursued since the 1980s.

It is within this context of ideological change and continuity of old approaches to food security that chile studies emerged in Mexico in the early 2000s. This took place in two separate but intersecting spheres: state-led efforts through SINAREFI and its "Network of Chile" and in academia, mainly in institutions such as the University of Veracruz, University of Chapingo, the Technological Institute of Conkal, the Technology Institute of the Central Valleys of Oaxaca, UNAM, amongst others. In this chapter, I will account for the development of chile research in these two intersecting spaces, their research trajectories, additions – such as the inclusion of gender perspectives –, the collaboration networks, as well as the surging political incentives and contradictions, mainly with respect to their influence on national food security policy.

The chapter's outline is as follows. First, I will shortly introduce the emergence of chile research in SINAREFI and in academia. Then, I will engage in an extended account of the Network of Chile in SINAREFI, its achievements and eventual decline. Here, I will detail the institutional innovations that the project promoted, such as an interdisciplinary approach that brought *agrónomos* and ethnobotanists together. Consequently, I will discuss the institution's sudden disappearance and the politics behind this eventuality. Second, I will trace the development of chile research in Mexican academia, especially, how aspects such as cuisine, local voices, and gender were integrated into this blooming research. I will then explain the shortcomings and limitations of chile studies in academia, particularly in relation to funding and the wider political motivations. Finally, I will discuss how the evolution of thought that favoured chile studies at the turn of century connected to national food policy. In particular, I will analyse how chile and flavour were integrated into food security programmes, and then

reflect on how political incentives led to contradictory approaches to food systems in SINAREFI and academia on one hand, and in national food policy on the other.

The Emergence of Chile Research: SINAREFI and Academia

When the Mexican government created SINAREFI in 2002 to integrate FAO's guidelines on food security and the conservation of agricultural biodiversity into national policy (with an emphasis on local crop genetic resources and their just access by indigenous or small farmers) this was not without conflicting interests. On one hand, SINAREFI became the first structured multidisciplinary and multi-institution effort to conserve and promote sustainable use of native crop genetic resources in the country. It was created under the auspices of the National Seed Inspection and Certification Service (SNICS) and the Ministry of Agriculture and consisted of strategic crop networks for those crops that originated, diversified, or were domesticated in Mexican territory. This encompassed 44 crops in total, categorised in five macro-networks: vegetables, underutilised crops, ornamental, basic and industrial, and fruits. SINAREFI's objectives included the implementation of *in situ* efforts under a state-led institution and a new focus on local food systems. On the other hand, SINAREFI was inserted within a wider, seemingly contradictory, state agricultural model which prioritised industrial production of export crops and the importation of basic grains including maize, the primary staple grain in Mexico (Rubio, 2013). This state model persisted throughout the 2010s, before and after SINAREFI's disappearance in 2014.

Between 2002 and 2014, SINAREFI engaged with initiatives such as the creation of Communal Seed Banks and participatory breeding projects with local communities (Córdova-Téllez, 2018, p. 5). These projects, contrary to previous government efforts that had been tethered to earlier models of agricultural development, would have different incentives beyond increasing crop yield and production. For example, aspects such as quality of life, nutrition, and traditional agroecological practices of peasants and local communities would be added to the institution's foundations. In addition, SINAREFI's official discourse highlighted

the valorisation of traditional knowledge, its link to local varieties, and the importance of preserving both knowledge and varieties for climatic, cultural, and culinary reasons.

Yet, SINAREFI's objectives and rhetoric were not always in apparent sync with the nation's broader food security scheme. This is visible in the inconsistencies which emerged in non-grain crop networks. In this chapter, I will account for SINAREFI's trajectory and its research on chile, which took place in the "Network of Chile", where ethnobotanists and plant breeders collaborated to undertake the first comprehensive survey of chile landrace diversity in Mexico. I will argue that chile, as a symbolic but non-grain crop, lay in a limbo between being *necessary* or only *culturally adequate* to the nutrition of a nation, primarily due to its flavour characteristics. In other words, I will argue that chile's cultural importance was underlined in SINAREFI but obviated in food security programmes.

Parallelly, chile research flourished in academia by the early 2000s, particularly in areas like ethnobotany and ethnoecology. By this point, chile continued to be studied and improved in agricultural institutions like INIFAP, as well as produced industrially in the north of the country, mainly by big agricultural enterprises that used (and still do) seeds produced by transnational companies. Yet, chile's link to cultural diversity would now be relevant research on its own. Whilst chile studies in both SINAREFI and academia expanded the knowledge and characterisation of chile diversity in Mexican territory, approaches from academia engaged more with interdisciplinary collaboration and with culture-related topics such as chile's connection to cuisine, local cosmologies, and the role of women in using and perpetuating chile varieties. By developing and valorising local accounts of chile under the framework of biocultural heritage, chile ethnobotanists were able to integrate previously overlooked spaces such as kitchens and practices such as women's knowledge.

Interestingly though, both research spaces, SINAREFI and academia, were inhabited by a similar group of scientists. Some of the same ethnobotanists who collaborated with the Network of Chile also published their own personal academic research. Institutional demands pushed chile research in different directions, particularly with respect to the improvement of local food pathways and the future visions of Mexico's crop conservation system. As the international agenda called for the reformation of food systems and crop conservation strategies in agreements such as FAO's International Treaty on Plant Genetic Resources for

Food and Agriculture, national efforts such as SINAREFI complied with the international mandate without abandoning wider political motivations. Even though the government engaged with local efforts such as creating Communal Seed Banks, the broader endorsement of food sovereignty aimed at building a *nationalistic* perspective; a sovereign Mexico that surveyed and safeguarded its own crop genetic resources. This positioning contrasted with ethnobotanical work that focused on studying *local* or *regional* chile landscapes. In these studies, cultural characteristics of chile, such as its many flavours and social meanings, were explored in much more depth. Hence, I will show that similar research can take different shapes in different places when guided by competing interests.

In this chapter, I explore these intersecting but separate avenues of chile research, alongside their trajectories and contradictions. Chile, as a symbol of national identity but a non-grain crop, is particularly enlightening for understanding how notions of cultural appropriate foods, biocultural heritage, and local food sovereignty were integrated into national crop conservation efforts in the 21st century – beyond caloric intake, famine, access, and supply. In this sense, this chapter will explore how political decisions regarding the priority of and desired approach to national food security objectives, agriculture policies, and state conservation efforts determine whether the latter can be successful and whom they will benefit. In the case of chile in Mexico, mismatched goals on food security and the failed integration of local knowledge and cultural elements into the political structure led to an inconsistent conservation scheme. Therefore, this chapter builds on existing accounts of crop genetic diversity by unveiling how flavour is framed in food security and conservation efforts beyond grains (Bonneuil, 2019; Curry, 2022b; Fenzi & Bonneuil, 2016; Fitting, 2011).

The Network of Chile: A Space for Chile Landraces

Octavio Pozo Campodónico, a pioneer chile breeder at the National Institute for Agricultural Research, wrote in the 1980s that most of Mexico's chile diversity was already known and used by local communities, but not by scientists (Laborde & Pozo, 1982; Pozo, 1981). 229Although ethnobotanists agree this is still the case (Aguilar Meléndez et al., 2018), in 2008

SINAREFI had other plans when inaugurating the Network of Chile as part of the vegetables macro-network. The Network of Chile aimed to achieve a comprehensive understanding of chile diversity, especially for local varieties.

As with other networks in SINAREFI, the Network of Chile encompassed a multi-institutional effort between different agricultural stations of INIFAP, where previous chile research had focused on commercial production. Also, it promoted interdisciplinary collaboration between plant breeders and ethnobotanists from several Mexican universities such as those from the University of Chapingo, Postgraduate College, University of Veracruz, University of Guadalajara, and Conkal Technological Institute. SINAREFI also promoted collaboration with local farmers and communities. In this sense, the 44 crop networks of SINAREFI linked existing infrastructure to new collaborative avenues within universities and research institutes which then connected with local populations (González Santos et al., 2015).

The Network of Chile represented the first time a state-led effort endeavoured to explore chile landraces or local varieties. As Moisés Ramírez Meraz, director of the INIFAP Program of Chile and collaborator of the Network of Chile expressed,

> "Since the 2000s we have been giving wild and native chile materials a lot of priority, and for this, SINAREFI was a very important. With the Network of Chile, we had more resources to go out and collect and rescue native and wild chiles. In the beginning, the collections were based on commercial varieties and the native ones were neglected, but it is crucial to conserve them…It is not like before there was no interest in native varieties, the problem was that there was no opportunity and no resources or personnel to include them in the programs" (personal communication, 2021).

Since its inception in 2008, the Network of Chile significantly expanded the number of chile varieties collected and conserved, with 2432 exemplars compromising 47 types of chile at the University of Chapingo, the most diverse chile seed collection in Mexico (Aguilar Meléndez & Lira, 2018, p. 80). Before this, the biggest collection belonged to INIFAP with 3857

exemplars consisting mostly of commercial varieties (INIFAP, 1996, p. 31). Moreover, the Network of Chile mapped chile diversity across the Mexican territory (Aguilar Meléndez, personal communication, 2022).

Yet, beyond collection, the project aimed to integrate the relationship between chile varieties and culture, resonating with SINAREFI's wider goals of developing strategies for the sustainable use of genetic resources, *in situ* conservation efforts, and improving Mexico's food security as per FAO's guidelines. Before the Network of Chile, landraces at INIFAP were regarded as economically inviable and too heterogeneous. Even if chile was a symbol of Mexicanity before SINAREFI, research was only focused on improving and collecting commercial varieties. In contrast, the Network of Chile engaged with small-scale production systems and types of chile that are only found regionally (Aguilar-Rincón et al., 2010). This significantly added to previous state-led chile research where yield and large-scale production were prioritized. In this sense, chile landraces acquired value within a framework of safeguarding Mexico's plant genetic and biocultural heritages.

This is visible in the Network of Chile's variety descriptions included in the book "The chiles of Mexico and their distribution" (Aguilar-Rincón et al., 2010) (Figure 4.1), the most representative publication of the Network, where the authors included topics such as local landrace chile uses, methods of harvesting wild and semi-domesticated varieties, and regional dishes and cuisines. In this text, we find that the local chile *costeño* from Oaxaca is an essential ingredient for local plates like "*mole de iguana, venado, enchiladas* and *salsas*" (López López & Castro García 2006, p. 151), that chile *de agua*, endemic to the central valleys of Oaxaca, is used as a cup by producers to drink mezcal at the end of the harvest as an act of celebration (Aguilar-Rincón et al., 2010, p. 25), and that chile *de monte* in Oaxaca is cultivated by Zapotec communities in the Istmo de Tehuantepec, whilst the chile *mirasol* in the coasts of Oaxaca is preserved by Chatinos, Mixtecos, and Amuzgos groups (2010, p. 105). In SINAREFI's vegetable report of 2016, local chiles "are still cultivated due to their interconnection with culinary richness, which is immersed in the ethnic and cultural complex that characterises Mexico" (Vera-Sánchez et al., 2016, p. 11). From this perspective, flavour, culture, and cuisine appear to become relevant on their own, separating chile's genetic diversity from its role as raw material for the development of commercial varieties.

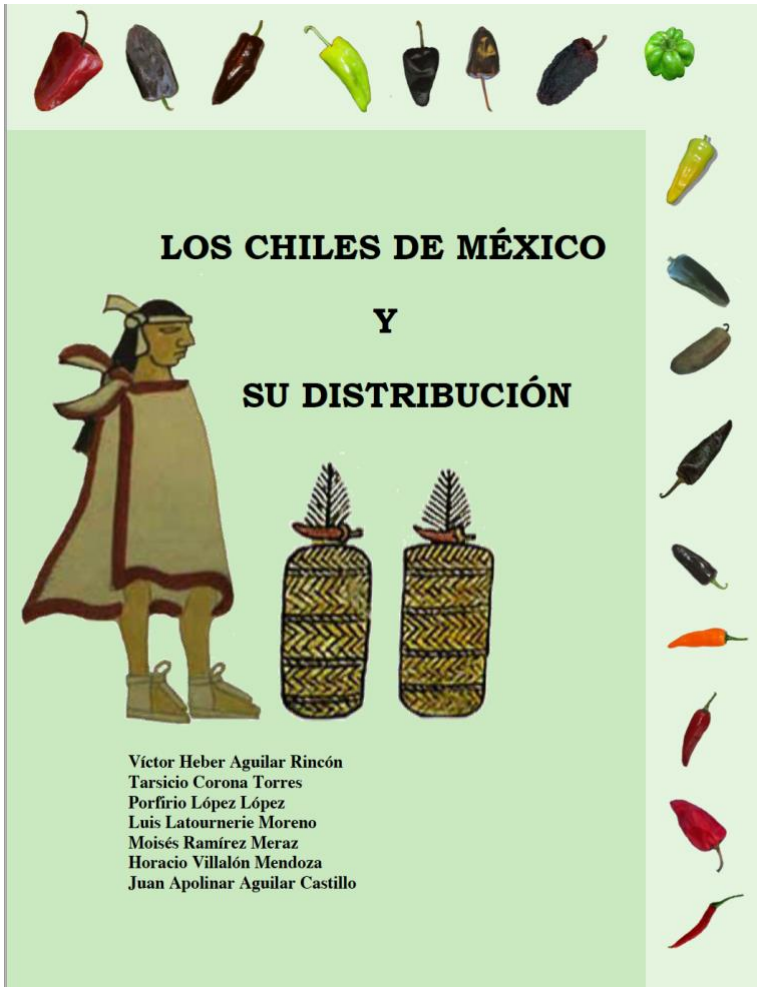

Figure 4.1 *The main publication of the Network of Chile "Chiles of Mexico and their Distribution", published in 2010.*

Publications from the Network of Chile integrated local spaces and actors in their analysis. For example, they sometimes explain if a given chile landrace is collected in the wild, harvested in home-gardens, or in small parcels (Aguilar-Rincón et al., 2010). They also explain whether consumption of a chile variety is for the household, for local exchange or sale, or for regional markets, and whether it generates basic or supplementary income for families in rainwater areas. This contrasted with previous agricultural reports, which focused mostly on commercial production and thus on morphological plant traits like yield rate, length, colour, market demands, and product uniformity (Laborde & Pozo, 1982).

Speaking about family income, Montes and colleagues (2006, p. 101) touch on how chile *piquín* or *del monte* in Tamaulipas is obtained "by the women and children in the communities of the region, who have reached an important degree of specialisation in terms of the harvest." Therefore, some studies touch on gender roles and local social dynamics. Aguilar-Rincón and colleagues specify that "the farmer is in charge of production and sale [of chile *huacle*, the main ingredient for *mole negro*] and occasionally, the housewife intervenes in its local sale" (2010, p. 20). In addition, they explain how chile *tabiche* from Oaxaca is sold exclusively by housewives (2010, p. 69), and how chile *bolita* is burnt by housewives to repel insects and snakes (2010, p. 78). In previous state-led research, women were mainly portrayed as buyers of "commercial chiles" (Laborde & Pozo, 1982); in the Network of Chile, women's role is portrayed as active producers, users, or sellers – alas not necessarily as knowledge producers.

In addition, local chiles were highlighted as a symbol of national identity by SINAREFI chile researchers, along with the re-valorisation of traditional cultures, cuisines, and flavours. López López and Castro García write that "Chile has constituted a cultural constant in the evolution of the Mexican people, to such a degree that it has been an obligatory ingredient in Mexican food for thousands of years" and "the variety of tastes, flavours and ingredients that are used in the country's kitchens in conjunction with the different chili peppers, has allowed the development of characteristic, exotic and inciting gastronomy, with a peculiar and suggestive taste, which despite foreign transformations and influences, retains a particular tonic, due, directly, to the variety of forms and ways in which chili is consumed in our country" (2006, p. 136-137). Therefore, at the Network of Chile, local chile diversity, along with its relation to local culture, agriculture, and cuisine, had a place inside the state's scientific infrastructure. That is, besides providing potential material for improvement, and by extension profit, the preservation and conservation of chile landraces appeared to have intrinsic value within the wider SINAREFI vision of safeguarding native genetic resources and advancing food security in Mexico.

Built on a nationalist agenda, SINAREFI aimed to show Mexico's alignment to global institutions such as FAO, along with international definitions of how crop conservation and

food security and sovereignty should look like. The consolidation of these foreign imperatives and the local prerogatives just described, however, was more easily said than done.

Emerging Contradictions and Decline of the Network of Chile

As worries from researchers and producers about the loss of local varieties became more prominent, chile was one of the most attended-to crops in Mexico; it received more funding than any other crop in the vegetable macro-network (Vera-Sánchez et al., 2016, p. 5). Besides being a crucial national symbol and part of regional cuisines, chile was and still is a remarkably profitable export crop. According to the Ministry of Agriculture in 2007 the production of chile reached 2249 tons and represented 8.6% of all crop exportations in the country, with a commercial value of more than 8000 million pesos (SAGARPA, 2008). In this light, the systematic study of chile diversity also made sense in terms of locating and acquiring potential genetic resources for future breeding. Within SINAREFI, native crops and their diversity were characterised as worthy of investment for the generation of improved varieties that contributed to food security efforts in the country. Yet, the ways in which SINAREFI and the Network could support efforts for food security remained vague; was it for local or regional production or for exportation? Or both? Plant breeders, ethnobotanists, and the state each had different perspectives on the matter.

The Network of Chile was successful in developing a systematic database of chile diversity (Figure 4.2). This database documented chile varieties' GPS location, botanic information, and, as stated above, some descriptions of local cultural uses. In total, the project mapped and collected 2432 accessions in 26 states of Mexico, including the species *C. annum, C. chinese, C. frutescens, C. pubescens, C. baccatum, and C. rhomboideum.* From these, 75% corresponded to the species *Capsicum annum,* the most diverse in the territory (Luna Ruiz et al., 2018, p. 104). Even when wild varieties were not specifically described in the Network's reports, the project mentioned 47 morphotypes from all collected samples, including both wild and domesticated chiles (Aguilar Melendez & Lira, 2018).

Moreover, *ex situ* conservation was significantly expanded with the addition of the 2432 accessions to the University of Chapingo's seed bank (Aguilar Meléndez & Lira, 2018). As Moisés Ramírez Meraz testified, "SINAREFI is the largest reservoir of chilli pepper genetic material, because we all [agronomists, ethnobotanists, and local communities] contributed to this collection. This bank is in Chapingo University, and it is possible that it will migrate to the National Centre for Genetic Resources [a branch institution of INIFAP]. All this material is with its passport data, characterised, and it is completely located because it is not allowed to send material with the minimum registration data. These are very important materials and from all over the country" (personal communication, 2021). Therefore, SINAREFI's chile database and collection extended the frontier of chile research and conservation in Mexico.

Figure 4.2 *Second edition of the collaborative map "Diversity of Chiles in Mexico", based on the research results of the Network of Chile, 2014.*

In addition to facilitating *ex situ* conservation in gene banks and mapping chile's diversity in Mexican territory, the local diversity collected by the Network allowed for the breeding of new varieties for production. For one, Porfirio López López, INIFAP agronomist at the Oaxaca headquarters and collaborator with SINAREFI, explains that activities in the state included the collection of Oaxaca's chile diversity and the subsequent development of improved varieties that considered regional and national demands (2022, p. 329). In particular, he exemplifies the case of chile *de agua*, mostly consumed in the Central Valleys of Oaxaca. According to him, the improved chile *de agua* surpassed the regional production yield by 26.5% whilst maintaining most of the original morphological and flavour characteristics (2022, p. 329). This initiative of developing improved varieties and distributing cheaper seeds to producers (especially small and medium) added to INIFAP's endeavour of breeding and producing seeds. However, these efforts were and still are mostly overshadowed by a national dependency on the US seed industry, especially from 1991 when the state lifted all restrictions for private seed commercialisation (Luna Mena et al., 2012; Moisés Ramírez Meraz, personal communication, 2021).

More so, an analysis of Network of Chile publications reveals a clear bias towards taxonomic and agronomic data, and a failure to connect this information with ethnobotanical insights or local epistemologies as had been sought in its objectives. Even when the Network of Chile advanced the transformation of chile conservation in Mexico to a more encompassing practice, it also continued a vision of amassing chile genetic resources for production purposes. Even when ethnobotanists like Aguilar Meléndez worked to include ethnographic and cultural elements such as culinary knowledge and flavour in the Network's studies of chile landraces, the priority was given to agronomic perspectives.

This hindered the liaison between different theoretical approaches to the crop's diversity and its value – which in turn shaped who could benefit from the project's results. According to ethnobotanist Araceli Aguilar Meléndez, power relationships affected the extent to which ethnographic and cultural insights could influence the Network's trajectory (personal communication, 2022). Cultural and especially culinary elements of chile, as those presented in the section above, remained descriptive rather than integral to the work. This perpetuated a long "resourcist", or utilitarian, view of crop research and conservation (Fenzi & Bonneuil,

2016) and also the gap between “science” and “traditional” knowledge. This outcome makes sense when one considers the wider food policy forwarded by the state, as will be discussed in the following sections.

Despite the internal power struggles, agronomist Ramírez Meraz and ethnobotanist Aguilar Meléndez did agree that the Network of Chile had been crucial for expanding academic researchers’ understanding of chile diversity and geography. This opinion was shared by SINAREFI’s ex-director, Rosalinda González Santos, who believed that in a stable political environment, SINAREFI could have been a more transformative initiative. However, from approximately 2014 onwards, the institution suddenly halted new research, something evident from the Network of Chile’s outputs. Although currently presented as an active agency on the government’s webpage, the Network seemed to fade from 2014. According to Rosalinda González Santos, this sudden collapse is explained by a general institutional funding-cut that happened with the changeover of the presidential administration of 2012, and which affected all 44 crop networks (personal communication, 2023). According to her, this is the main reason why the Network of Chile remained in a diagnostics phase: after resources stopped in 2014 it was not possible to consolidate further *in situ* or community projects. Yet, she noted that other networks like that of maize did achieve more solid researcher-producer collaborations before 2014 due to a stronger existing infrastructure and research network which developed before the creation of SINAREFI.

The apparently sharp turn of fortune in 2014 was, in a sense, years in the making. After seventy years of rule by the Institutional Revolutionary Party (PRI), a divided and impoverished Mexican population turned to the conservative right wing National Action Party (PAN), which won presidential office in 2000. The new government rapidly attempted to portray a modern and progressive image by aligning itself with international policy, in particular with respect to the environmental and the sustainability agendas. This had propelled the creation of SINAREFI under the International Treaty on Plant Genetic Resources for Food and Agriculture. Nevertheless, after two six-year presidential administrations and twelve years marked by growing neoliberal policies, economic crisis, ever increasing inequalities, and the exponential rise of violence due to the state’s war on drug cartels, the PRI regained political power in 2012. With the party change came the dismantling and re-

structuring of PAN's reforms, including SINAREFI, which lost most of its budget by 2014. As twentieth-century Mexican history has repeatedly shown, administrative change, more commonly than not, has brought forward categorical institutional transformations, generally with the intention of purposefully blocking the predecessors' projects (Ochoa, 2000).

Whilst receiving constant financial support from SINAREFI since its creation in 2008, the Network of Chile was able to progress uninterrupted with the chile diversity characterisation and creation of a landrace database. As SINAREFI's ex-director Rosalinda González Santos describes, during this period, even when economic resources were very basic, the continuity of funds helped to solidify a stable network of researchers and institutions, and very importantly, a constant set of activities such as collection fieldtrips, new information analysis, conferences and fairs, and publications. According to her, one of SINREFI's advantages was that it used existing infrastructure to implement the crop networks – and when non-existent, it pushed for the creation of relevant additions. That is, through its multi-institutional scheme, SINAREFI connected existing professionals, university facilities, and seed banks where the research could be conducted and processed. However, when resources decreased to an absolute minimum, the Network of Chile was only able to endure by re-using already-existing research material and publishing past results.[1]

In an attempt to perpetuate SINAREFI's legacy, in 2018 the National Commission for the Knowledge and Use of Biodiversity (CONABIO) inaugurated the project "Mexican Agrodiversity" using SINAREFI's data on native crop landraces. Unfortunately, the scope diminished. It went from being a national state programme to a project within another institution, one with limited funding until 2023. As all crop networks within SINAREFI were disrupted by the political changes, the long historical division between agricultural science and areas like ethnobotany and the social sciences was reinstated once again. The lack of funding and infrastructure blocked the continuation of this state-based conservation effort that aimed at protecting native landraces as part of Mexico's genetic and biocultural heritage. Due to its abandonment, SINAREFI's purported objectives of delivering sustainable use,

[1] For example, the text "Conservation and Sustainable Use of Vegetable Crops in Mexico" that recounts the actions of the Vegetable Macro-Network from 2002 until 2015 (Vera-Sánchez et al., 2016).

access, and conservation of native crop resources by integrating local peoples and communities fell short of real results.

SINAREFI's downfall, however, was linked to a much bigger panorama that inevitably shaped the extent to which crop research and conservation strategies could benefit (or not) disadvantaged populations: the national food security and agriculture policy. Since the 1980s, food supply in Mexico had increasingly depended on grain imports and on the export of profitable crops, mainly vegetables and fruits (Suárez, 1982). This forwarded paternalistic food security strategies that centred on direct money transfers for marginalised groups rather than boosting regional production of local landraces or even improved varieties (Rubio, 2013). The contrasting two-fold strategy set in motion by PAN's creation of SINAREFI, a model for landrace conservation with a supposed focus on local initiatives, whilst continuing an agroindustry importation-exportation model suggests that the top-down political interests were not truly directed to promote "just access of the genetic resources" for the entire Mexican population. Regardless of the intentions of scientists and other collaborators in SINAREFI to advance a conservation system that benefitted local communities − the true safekeepers of most biocultural diversity −, broader economic and political motivations blocked structural change.

This was evidenced in the "Law of Rural Sustainable Development" established in 2001 as part of Mexico's alignment to international expectations, in which the government supposedly aimed at improving the living standards of rural habitants by implementing a sustainable food production system. As a constitutional law, it applied to all institutions that contributed to food production, distribution, supply, and access (Ávila Curiel et al., 2011) – and it was to be enacted by the SNICS through SINAREFI. The law presented food security and sovereignty as joint goals, respectively defined as "the timely, sufficient and inclusive supply of food to the population" and as the "free determination of the country in terms of production, supply, and access to food for the entire population, based fundamentally on national production" (Ávila Curiel et al., 2011, p. 19).

In this law, both food security and sovereignty were framed only at a national scale, which is especially telling as the latter concept is also generally related to local and peasant struggles to self-determinate food systems (Via Campesina, 1996). This means that matters

like local production and the improvement of conditions for small and subsistence farmers were overlooked in this law, perpetuating rather than addressing the state's long-standing rural abandonment. The sharp division between big and small producers, and between agroindustry (under the wing of transnational companies) and subsistence agriculture, was maintained amidst the official enunciation of sustainable rural development in the constitution.

Even when SINAREFI's goals projected a local valorisation of native crops and aimed at implementing *in situ* efforts such as Communal Seed Banks, the bigger picture was to convey an image of the government to institutions abroad. Mexico was to be portrayed as a country in line with global discourses, that is, as a "modern" or "progressive" nation that sought both economic growth and the sustainable management of resources. SINAREFI's strategy then underwrote the creation of a national system for the conservation and research of native crop genetic resources and recognised local biocultural diversity as valuable. Ironically, this parted from the food security programmes forwarded by the state in parallel.

With SINAREFI's halt, the study of chile's flavours and cultural meanings were relegated to academia. As the Network of Chile came into being and out of being, some of the participating researchers built their academic trajectories parallel to SINAREFI, and beyond it. Whilst the Network of Chile worked under SINAREFI's objectives of scouting and systematising chile's diversity, academic institutions granted more freedom to focus on cultural and social insights – those that the Network Chile could not engage with.

Chile Research in Academia: Gender, Flavour, and Biocultural Heritage

Despite the fragmented effort of SINAREFI, a branch of chile-focused ethnobotanic research emerged in the 21st century. Even when limited in quantity, scope, and reach if compared to staple crops like maize or beans, this new avenue of chile investigations proved to be remarkably fruitful. These studies were characterised by interdisciplinary collaboration, and by the exploration of previously neglected topics such as flavour, culinary traditions, gender

dynamics, and even emotional aspects of chile landraces. In doing so, these academic projects expanded the value of chile beyond the framework of science.

This renewed interest in the cultural aspects of chile diversity, however, did not happen in a vacuum. From the 1970s, cultural heritage studies, alongside feminist and decolonial perspectives had been germinating in the social and human sciences around the world (Cusicanqui, 1979, 1987, 1997, 2010; García Canclini, 1989, 1999). Within these avenues, researchers developed an interest in questioning the essentialising and extractivist practices of Western research in non-Western territories. More so, as accounted for in the last chapter, Mexican ethnobotanical and agroecological research from the 1970s pushed for the revalorisation of indigenous agricultural and ecological knowledge as drivers of diversity (Hernández Xolocotzi, 1970, 1977, 1985; Toledo & Moguel ,1996; Toledo et al., 1998; Vásquez Dávila, 1997).

By the 1990s, renewed approaches to cultural heritage questioned the materiality and meaning of heritage as something located exclusively in the past. Scholars began to situate heritages as culturally constructed phenomena which are constantly negotiated in relation to the present needs of a given group, thus developing the field of critical heritage studies (Gentry & Smith, 2019). This evolution of thought, hand in hand with an increasing dialogue between disciplines, resulted in the concept of biocultural diversity and heritage in the 2000s (Maffi, 2001; Posey, 1996, 1999; Toledo & Barrera-Bassols, 2008). Here, the connection between biological diversity and cultural diversity became explicit. Generally adopted in scholarly and political discourse from the 2010s, biocultural diversity's link to heritage allowed the inclusion of memory and living legacies to conservation projects, which propelled a deeper thought and consideration of communities' relationship to their local ecologies, identities, practices, knowledge, and changes through time (Boege, 2021). This, according to the International Institute for Environment and Development, emphasized that regional biological resources are *historically* constructed alongside local populations (Boege, 2021, p. 30). In a way, the term crystalised a three-decade political and intellectual endeavour to defend indigenous rights and their recognition as safekeepers, promoters, and drivers of biological diversity (Maffi, 2001).

Biocultural heritage resonated especially in the Latin American social, political, and academic contexts. According to Eckart Boege, Mexican ethnographer and expert in biocultural heritage studies, the term was introduced in the region by Alejandro Argumendo, representative of "Asociación Andes, A.C." and founder of the "Parque de la Papa", through his efforts to protect the potato cultural complex and diversity in Perú (2021, p. 32). The concept, translated as *patrimonio biocultural,* had deep roots in the communal and collective aspects of local peoples and their environments. As Boege puts it, this term is "a broad concept referring to the collective inheritance of identity common goods with the idea of defending the community itself" (2021, p. 33). Therefore, *patrimonio biocultural* promoted a significant practical defence of communities, their diversity, their traditions, territories, and food systems. This informed ethnobotanical, agroecological, and ethnographic studies in Mexico, which threaded to the long history of re-valorising indigenous diversity, knowledge, and traditions to construct a progressive pluri-cultural, multi-ethnic, and mega-diverse Mexico (Toledo et al., 2019).

In line with this trend, Mexican biologists increasingly pushed for the integration of local ontologies into the very making of academic research. This was represented in the celebrated approach of "Kosmos, Corpus, Praxis" to study multiculturality (Alarcón-Cháires & Toledo, 2003). Through the triad of "kosmos" or beliefs, "corpus" or systems of knowledge, and "praxis" or practices, scholars aimed at validating the epistemic and situated relevance of local cosmologies in parallel to science. Continuing their role as mediators between science and local knowledge, ethnobotanists, agroecologists, and ethnoecologists explained that bridging the scientific and local worldviews was necessary to create more plural and adequate strategies for sustainable development and biocultural conservation (2003).

Drawing on the connection between cultural and biological diversity, early chile-specific research highlighted the erosion of genetic resources as associated with the loss of cultural practices. Examples of these emerging studies included the analysis of a Mayan chile classification system in Yaxcabá, Yucatán (Latourneire et al., 2002), the ethnobotany of the chile *piquín* of the Sierra Gorda de Querétaro (Martínez Torres, 2007), a study of native chile diversity in Oaxaca (López López & Castro García, 2006), and an ethnobotanical analysis of the wild variety *chiltepín* in the northern state of Sonora (Bañuelos et al., 2008). In addition to

highlighting the importance of cultural practices in perpetuating local chile diversity, these studies signalled the limited understanding of Mexican chile landraces in academia and its detrimental effect in developing proper conservation strategies – something that INIFAP *agrónomo* Octavio Pozo Campodónico had already noted in the 1980s. In this sense, attention to chile diversity and its loss became evident in academic spaces, parallel to SINAREFI's incipient crop networks, where some of these researchers collaborated.

One relevant case was that of chile pioneer – and Network of Chile collaborator – Araceli Aguilar Meléndez, who emerged as an expert in chile ethnobotanical studies in this period and who integrated gender perspectives and culinary knowledge into her work. Educated as a biologist, she completed her doctoral studies at University of California, Riverside, in 2006. As she narrates, the idea of analysing Mexican chile local diversity through a PhD in plant biology related to a life-long interest in kitchen practices and culinary diversity, which paired with her passion for science (personal communication, 2022). Growing up in a multicultural context, Aguilar Meléndez's journey living in Mexico City, Veracruz, and California allowed her to develop an interest in the relational dynamics of chile in its local settings beyond the constrictions of scientific thought.

Aguilar Meléndez's professional trajectory was informed by her context as a woman in science. In time, her rhetoric diverged from that of previous ethnobotanical work in the 1970s-1990s insofar it called for attention to crops' associations to culinary knowledge, women's roles, and flavour. More so, Aguilar Meléndez explained that ethnobotanists and biologists frequently focused on formal interviews and on plant sample extraction in communities without really interacting with the local habitants, especially with overlooked actors such as women (personal communication, 2022).

In her doctoral work, Aguilar Meléndez explored molecular data alongside historic, linguistic, and recent ethnobotanical records to document the diversity of chiles throughout human history in Mesoamerica (2006). This became the first exhaustive account of Mexican chile diversity to integrate both biological and cultural factors as a main axis of analysis. Here, she explored local chile diversity in 10 Mexican states (Veracruz, Oaxaca, Puebla, Chiapas, Yucatán, Quintana Roo, Jalisco, Michoacan, Guerrero, and Morelos) and collected 518 wild and 111 domesticated cultivars in home gardens, local parcels, and markets or *tianguis* (2006,

p. 39). Aguilar Meléndez found that wild and domesticated types of chiles are widely used in smaller towns, where they are grown in home gardens or intercropped fields. Her argument situated the cultural context, alongside botanical characters, as essential to understand wild populations of chile. According to her, the interrelation between culture and wild chile diversity should "convince the scientific community" about the specific human-chile plant relations, different from other basic Mesoamerican crops like maize where wild types or *teosintes* are not used anymore for consumption purposes (2006, p. 38). As such, Aguilar Meléndez remarked the importance of expanding the knowledge of cultural preferences, in particular food traditions, noting that the diversity of Mexican food was associated with that of domesticated and wild chiles.

In the following years, chile studies made their way through interdisciplinary collaborations (Aguilar Meléndez et al., 2009; Aguilar Meléndez et al., 2021; Luna Ruiz et al., 2018). This particularly materialised in two books edited by Aguilar Meléndez, ethnographer Marco Antonio Vásquez Dávila, anthropologist Esther Katz, pedagogue Maria Reyna Hernández Colorado, and ethnobotanist Gladys I. Manzanero Medina. The first volume, "*Los Chiles que le dan sabor al mundo*" ("Chiles that Give Flavour to the World") brought together a uniquely diverse set of authors and stories (2018). The second book, "*Chiles en México: Historias, culturas y ambientes*" ("Chiles in Mexico: Histories, Cultures, and Environments"), was a continuation of the first volume, expanding the interdisciplinary conversations (2021). Both volumes centred on the biocultural relevance of chile and its symbolism in different sectors of Mexican society.

Additions to these volumes ranged from academic accounts of chile in ethnogeography, ethnoecology, molecular genetics, agronomy, anthropology, archaeology, and linguistics, to personal stories, local accounts of women's traditional culinary knowledge, restaurant chefs, and chile landrace production. Moreover, the books encompassed different cultures and their regional chile varieties, accentuating the local significance of the crop in terms of cuisine, rituals, and/or medicine. As ethnobotanist Gary Nabhan emphasized, this effort touched on how traditional knowledge associated to chiles has been pivotal to the identity of many cultures in Mexico, to the conservation of its genetic resources, and to the totality of the biocultural heritage of the country (2018). Not only was the crop conceptualised

beyond the usual division between agricultural science and ethnobotany, but it incorporated knowledge beyond academia into a scholar publication.

This is evident in the chapters of expert women cooks or *cocineras* such as Aurora Toledo Martínez and Lorenza Balam Canché, who invoked memory, flavour, and inherited practices to describe the importance of local chiles in Oaxacan and Mayan cuisines and cultures. Toledo Martínez shared a story of the *shigundu* chile, a specialty of the Istmo of Tehuantepec in Oaxaca, southern Mexico. The *shigundu*, a small, bitter, and spicy chile, is found in the wild near milpas and fields, and is essential for the local salsas and plates. From adding *shigundu* to atole[2] , to tomato sauce, beef broth, or biting them fresh, this regional chile adds a particular flavour and belonging to communities in the area. Toledo Martínez emphasised how chile *shigundu* is part of the local stories and tales, and therefore, of the imaginary and identity of the people in the Istmo (2018, p. 71). In the process, she denoted the primary role of women in handling chiles, which "in the kitchen always accompanies women and… become part of the conversation, splashing over their magical spice" (2018, p. 72).

In a similar line, Balam Caché described how food is central to the lifeways of the Mayan.[3] She narrated how women prepare local plates with care and affection for family and visitors, where chile is a protagonist. As she states, "food is a moment of sharing to which chile adds flavour" (2018, p. 110). In this sense, the voices of these women highlight how chile has been central to their personal expression, trajectories, and culinary creations. Their backgrounds as experts cooks or *cocineras* added a new turn to this ethnobotanical endeavour by portraying insights from a perspective of care, heritage, storytelling, embodied knowledge, and sensorial perceptions.

These volumes also integrated varying insights from the humanities and arts, highlighting ethnobotany's broader commitment to interdisciplinarity (Toledo & Barrera-Bassols, 2008; Lira et al., 2016). For one, anthropologist Laura Corona de la Peña argued that the appropriation of ingredients and the creation of flavours comes from a process of cultural

[2] Maize-based traditional hot drink, which varies in ingredients depending on the region. In Oaxaca, it is common to add chile to atole.

[3] The text is originally in Mayan, with a translation in Spanish.

construction – one needed to survive instances of change, colonisation, and cultural imposition (2018, p. 156). Corona de la Peña established that there is not *one* Mexican traditional cuisine but a variety of them, where the connections between people, ingredients, and territories resulted in different food cultures. Chile, then, is not part of one Mexican cuisine, but of many. Corona states that the importance of conserving biocultural heritages comes not from the definition of institutional experts but from the people that relate, handle, and process, and live in these food cultures (2018). In this sense, the value of chile is more connected to the local perceptions of importance and use, rather to an idea of "resource", more linked to SINAREFI's rhetoric or that of agricultural science more broadly.

Following this thread, Esther Katz, renowned anthropologist and chile scholar, explored chile's links to Mixtec culture in Oaxaca. Katz explained how Mixtecs consider chile a marker of local identity in terms of having the ability to eat spicy local chiles, such as *costeño* and *piquín*. This ability differentiates Mixtec culture (and especially men) from city inhabitants and *gringos* or foreigners (2018, p. 201).[4] Yet, as Katz discussed, chiles are mainly processed by women since they are the ones to cook local plates such as yellow mole[5], a pre-Hispanic specialty of the region (2018, p. 201). Therefore, chile can be both a twofold indicator of gender in different spaces: a sign of masculinity when eaten and of femininity when processed. In her contributions, Katz also analysed how chiles can be a marker of social class in contexts where indigenous foods are linked to lower or poorer social backgrounds (Katz, 2018, p. 201).

Chile's complex cultural meanings and the ways they shape identities are also integrated in these volumes as markers of resilience. Ethnobotanist Gladys Manzanero and colleagues described how chiles and culinary traditions reflect instances of belonging, of adaptation, and of biocultural conservation in the borough of Iztapalapa in Mexico City. As an

[4] A similar account of chile, masculinity, and the sensitivity of foreigners to spice, can be found in Demanget's chapter "*El calor sustancial de los alimentos*" in the second volume mentioned above (2021, pp. 215-235). She also touches on the "gastronomization" of indigenous cuisines and the institutionalisation of their identities, their food, and histories by urban elites.

[5] A pre-hispanic type of "mole" based on the combination of maize and chile guajillo or puya, and previously it was cooked with chile costeño (Katz, 2018, p. 201).

area of the city with pre-Hispanic roots, the authors described how cultural continuities live through the quarter´s food traditions, especially through the use and consumption of chile *guajillo, serrano, pasilla, and poblano*; all found in the local market. By using them in typical plates such as shrimp broth, *charales*[6] in green sauce*, michimole*[7], fish tamales, and red or green *pipián*[8], Iztapalapans have been able to perpetuate their identity and adapt to the current biocultural homogenisation ongoing in urban centres (2021, p. 142).

In addition, the association between chile, cuisine, and ideas of value – more generally present in anthropological, sociological, or historical studies – is given a central place in the scientific contributions of the volumes. For one, Güemes Jiménez and Aguilar Meléndez explore the ethnobotany of chile in the southern area of the Huastec of Veracruz, where otomí and nahua communities produce and consume the *pitsahchili,* a local variety valued for its particular spice and taste (2018, p. 241-242). Along these lines, ethnoecologists Ruiz Núñez and Vásquez-Dávila (2018) explored the beliefs, knowledge, use, and production of wild chiles from the species *Capsicum annuum* var*. glabriusculum* in the Zapotec community of San Juan Guelavía, Oaxaca. The *guien guiix* or "chile from the field" (2018, p. 273) is known to be dispersed by birds and to grow near thorny bushes like hackberries and *mesquites*. With this knowledge, habitants of Guelavía have fostered an agroecological management of the chile plants. Moreover, Zapotec ethnobotanists Reyna Dominguez Yescas and Gabriela Linares Sosa and described a traditional chile paste from her natal community of San Juan Juquila Vijanosin the Northern Sierra of Oaxaca, denoting the biocultural and transgenerational importance of this recipe (2021). These contributions show that chile scientific studies began to validate and position local knowledge in more equal terms with a scholarly framework.

This was certainly a steppingstone in chile academic research. Emerging from ethnobotany, and in conversation with multiple fields, these pluralistic contributions challenged previous accounts of the crop as a generalised symbol of Mexicanity.[9] Chile, still a

[6] Small fish variety found in fresh water. They are endemic to freshwater bodies in the Centre of Mexico.

[7] Fish broth prepared with chile guajillo and vegetables (Manzanero et al., 2021, p. 125).

[8] The pipian is a type of thick sauce made with squash seeds, chile, tomato, vegetable leafs, and chicken or duck (Manzanero et al. 2021, p. 128-130).

[9] For example, that of agricultural scientist Pozo Campodónico (1981, 1982).

unifying symbol of Mexico, now represented a vision where different cultures, identities, landraces, and cuisines existed on their own terms (Corona de la Peña, 2018; Katz, 2018; Manzanero et al., 2021). More so and very importantly, chiles were now linked to culinary spaces, which enabled the acknowledgement of women as main practitioners, perpetuators, and carriers of knowledge.

In this respect, academic research deepened cultural, social, and political aspects of chile, topics which remained superficial in the Network of Chile. Even if both spaces were represented by similar researchers, such as ethnobotanists Araceli Aguilar Meléndez and Luis Latourneire, and *agrónomos* Porfirio López López and Moises Ramírez Meráz, and by a mutual interest of understanding local chile diversity in Mexican territory, research in academia allowed for more space to explore cultural practices and gender perspectives. As universities (even if public) were not directly tied to the political climate, this granted researchers the freedom of exploring a wider range of topics as those mentioned above, and very importantly, the continuity that SINAREFI did not have. Despite the scarcity of chile-specific projects and of general funding in ethnobotanical research, this academic chile network survived the Network of Chile and continues to grow to date.

However, the expansion of chile studies and Mexican native crops more generally did not come without limitations. The state's policies halted rather than promoted research (and its practical application) by perpetuating a homogenising and paternalistic notion of development and progress, in particular with its approach to national food policy (Gálvez, 2018; Ochoa, 2000; Rubio, 2013). One such example was the funding cut of SINAREFI. The binary separation between the crop research undertaken in SINAREFI and in academia on one hand, and the national food policy on the other, proved telling of the state's true priorities: the continuation of a market-based food system based on large-scale agriculture, the importation of grains, and the exportation of high-value horticultural crops. This was visible in the ways in which chile, flavour, and local food preferences were accounted for in food welfare programmes.

Mexican Food Security Programmes, Chile, and Taste

Within SINAREFI and academia, chile and other native non-grain crops gained importance beyond calories for the attainment of food security. This means that cultural aspects like flavour and cultural preference were increasingly integrated into official discourse. Yet the extent of this integration was not very clear. Thinking about chile and the state beyond SINAREFI poses an interesting but overlooked question: if chiles (and other non-grains) were considered fundamental to the Mexican diet mostly because of taste qualities and other nutritional advantages like vitamins, how were they framed in food security programmes in this period, if at all? I will answer this by accounting for the state's enforcement of food security in welfare programmes, their inclusion of chile, and the contradictory nature of these efforts compared to those like SINAREFI and academia. Lastly, I will reflect on the need to seek real governmental structural change towards regional food sovereignty, and why flavour diversity matters to the attainment of food security and sovereignty.

As the Mexican state adopted a neoliberal model from the late 1980s, food security programmes pivoted from a national "universalist" welfare strategy to targeting families in poverty (Ochoa, 2000). The measure for identifying poverty and food insecurity was the total price of the "Basic Food Basket" or *Canasta Básica Alimentaria* (CBA); a list of 34 main foodstuffs considered pertinent Mexican nutrition and diet. The CBA, mentioned in the previous chapter, was determined by the government's National Plan for Depressed Areas and Marginalised Groups (COPLAMAR) in 1982 and since then served as a guideline to standardise minimum wages (INEGI, 2020; Vesarez Zúñiga, 2022).

The CBA became the foundation of targeted food security welfare programmes, and therefore informed which types of foods and flavours were given to those categorised as poor and marginalised. From the late 1990s and early 2000s, welfare programmes, namely Progresa (1997-2002), later Oportunidades (2002-2014) and then Prospera (2014-2018), implemented direct cash transfers to their beneficiaries. In conjunction, Diconsa, a state-owned agency, provided accessible, low-cost foods, and other essentials through a nation-

wide network of community stores. Diconsa mostly sold foodstuffs included in the CBA (Martínez Rivera, 2009).

As a basic crop in the Mexican diet, chile was a part of the CBA since its inception, among other foodstuffs such as maize, wheat, beans, rice, vegetable oil, eggs, milk, pasta, meat, chicken, tomato, and banana. Interestingly, with time the official basket veered away from fresh fruits and vegetables towards industrialised products. Whilst the first basket in 1981 included fresh tomato, chile, onion, lettuce, and carrots plus a range of fruits, the 1998 the basket only included canned tomato puree and processed chiles as vegetables and no fruits (Martínez 2009, p. 25). This trend continued in 2005 when Diconsa's main basket only included canned chiles as vegetables (Diario Oficial, 2005). The same applied for 2013 (Vázquez Pérez & Ayala Ortiz, 2014) and 2015 (Diconsa, 2015).

Therefore, if chile is a barometer for the integration of flavour – itself a proxy for cultural preferences – into state food security programmes, then one could say that state efforts did indeed contemplate preference and taste. Canned chiles have been part of the CBA for decades and are still sold at subsidised prices in over 22 000 Diconsa stores throughout the country. Moreover, chiles represent the only vegetable on the list, alongside products like meat, milk, eggs, and lentils (CONEVAL, 2022; Diconsa, 2015; Martínez Rivera, 2009).

Yet, chile's inclusion in the biggest food security programme of the country may also reflect the homogenisation of Mexican diets. Chile variety in Mexico accounts for over 90 varieties, most of which are used, processed, cooked, and consumed in different culturally significant ways by different groups (Aguilar Meléndez et al., 2018). The chiles included in Diconsa's CBA are canned (industrialised) and are mainly jalapeños, *serranos*, and *chipotles*. These are widely consumed but also major commercial products that are replacing local landraces.

This is not to say that the supply of low-cost or processed foods in marginalised areas was "bad", the wellbeing and nutrition of food insecure groups is crucial. The issue is that on one hand, the state dictated that biocultural conservation mattered for enhancing food security (through SINAREFI), and on the other hand, it perpetuated food policies that actively

eroded networks of agroecological practice, of culinary traditions, and of local production and exchange.

This means that instead of fostering local production of chiles and other native crops, which would bestow more food sovereignty to marginalised groups, satisfy their cultural preferences, and favour biocultural conservation, food policies have remained short-sighted and paternalistic (Pasquier, 2019; Rubio, 2013, 2019). For over two decades, cash transfers and the supply of subsidised and industrialised products have remained the main strategy to grant food security to the Mexican population. More so, this strategy has failed to provide a solution to the import-export model and the volatility of crop prices (Rubio, 2013, p. 66), which are the root cause of food insecurity in the first place.

That Diconsa included chiles in the CBA does not mean that cultural requirements were met. The homogenisation of diets in marginalised areas not only affected local culinary traditions, but also reduced the consumption of fresh vegetables and fruits (Vázquez Pérez & Ayala Ortíz, 2014). This paternalistic approach, in line with an agricultural model based on free markets and dependency on grains, has forwarded the erosion of local chile varieties. As industrially produced chiles increasingly dominated the domestic and foreign markets, local varieties became too expensive for local production and sale (Aguilar Meléndez et al., 2018). This is visible in Oaxaca, the most chile diverse region of Mexico, where vendors of the main city market or *Central de Abastos* now struggle to sell endemic chiles as their prices have skyrocketed in the last 10-15 years. According to Carlos, chile vendor at the stand "El Oaxaqueño", this has been caused by the introduction of cheaper, industrially produced chiles brought from northern Mexico and imported from countries like China and Peru (personal communication, 2022).

Whilst a problem not particular to chile, this case clearly shows how the capitalist agricultural model followed by the state actively halted local networks of knowledge, culinary traditions, and exchange, by making local foods inaccessible to people – aspects vital for the attainment of situated food sovereignty. Without local chiles and their irreplaceable flavours, situated culinary traditions are gradually lost. Their cultural relevance and their role in local diets cannot be replaced with canned chiles. Through their use in often overlooked sites of

conservation, such as kitchens, is where biocultural diversity is truly perpetuated (Pérez-Volkow et al., 2022).

Even though chiles were framed as important for food security and sovereignty by SINAREFI and academia, along with other non-grains native crops, the real intention of the government was not to change the national agriculture and food model towards one of local production and self-sufficiency (Rubio, 2013). This is evident when considering the welfare programmes' allocated resources. While the flagship welfare programme Oportunidades received up to 50,000 million pesos until 2014 (Hernández Licona et al., 2019),[10] SINAREFI only received 50 million – with an approximate average of one million per Network (González Santos, personal communication, 2023). Therefore, there has been a clear inclination towards targeting poverty through direct economic transfers instead of forwarding structural reforms that boost local food production and commerce; reforms that are necessary to achieve a fairer distribution of wealth in rural Mexico. As argued by Ochoa (2000), this patronising type of policy was informed by electoral motivations rather than building solid social welfare strategies in Mexico.

According to the National Council for Evaluation of Social Development Policy (CONEVAL), in 1992 there were 18.6 million people (21.4% of the population) with an insufficient income to afford a CBA per month, and 46.1 million (53.1% of the population) could not afford a CBA alongside basic goods and services such as health, education, and transport (CONEVAL, 2018). By 2014, the year SINAREFI halted activities, 24.6 million people (20.6% of population) could not afford a CBA and 63.8 million (53.2 % of population) could not afford a CBA + services (CONEVAL, 2018). Therefore, levels of food security – in the way

[10] The Proyecto Estratégico de Seguridad Alimentaria (PESA) was created in 1994 by FAO for targeting food insecurity in developing countries and adopted in Mexico in 2001. It worked through the Ministry of Agriculture and aimed at "increasing agricultural production and productivity, promoting self-sufficiency and local markets… technological innovation and improvement, and generating local organisations" (Mackenzie, 2017, p. 36). The programme received approx. 2550 million pesos until 2014 (Gimate Baños & Muñoz Rodríguez, 2017, p. 238), when it was attached to "Oportunidades" and then dissolved in 2019 with the new administration of the National Regeneration Movement (MORENA).

conceived by the state – did not improve over 22 years despite the introduction of cash transfer welfare programmes like Progresa, Oportunidades, and Prospera.

The consideration of flavour as a culturally adequate element in Mexican diets was indeed integrated in SINAREFI, in academia, as well as in Diconsa-Oportunidades (and other cash transfer programmes) through chile. The overarching difference is that the first two did so through the revalorisation of local diversity and cultures, whilst pushing for the revitalisation of local food pathways. Yet, they failed to induce ground-breaking change due the overarching political agenda. On the other side, food welfare programmes provided a paternalistic and homogenising solution through supply and access, rather than fortifying local production systems. These overlapping trajectories capture the complexity of dynamics that surge in different levels of food policy, agriculture, and crop conservation in Mexico. They show that mismatching ideas can co-exist in the same concept of food security, in the same country, and in similar institutional infrastructures. Here, the recent history of chile's research and its integration into food security policy highlights discourses on academia and policy, and their intersections, are layered, malleable, and often contradictory.

Attention to local cosmologies and cultures in the Network of Chile and more deeply in academic studies was helpful to emphasise aspects of chile diversity and conservation that have been neglected by food welfare programmes. These shed light into previously overlooked food traditions, flavour, culinary gendered knowledge, and a variety of dishes – all of which are intrinsic to Mexico's biocultural diversity. This, however, was not transferred to continuous institutional action, or at least has not yet been. Unfortunately, after the disappearance of the Network of Chile, the institutional study of chile's flavours and cultural meanings remained enclosed to academia, especially to ethnobotanical work, and in a handful of places, such as the University of Veracruz and INIFAP.

Yet, the fact that chile was integrated into national food security programs reveals the importance of flavour, preferences, and taste, even at the highest levels of food politics. As a basic ingredient for Mexican cultures, analysing chile and other non-grain crops can unveil the importance of forwarding policies that promote and strengthen local production systems; ones that consider the decisions, needs, flavours, and lifeways of those involved. Chile has a role in providing nutrients, but in the case of Mexican food it is unrivalled in satisfying palates,

in giving food particular notes, in provoking sensations and sentiments of belonging. These are all essential elements for a "culturally adequate" diet, a requirement for food security according to supposed authorities in the topic such as FAO. Ironically, these elements have been neglected by food security policy in Mexico.

Highlighting flavour in the quest for more diverse, locally sourced diets, can evidence the fundamental role that intangible elements have in the quality of a diet, of a meal, of a food system. Such elements underwrite the multidimensional nature of food and the right of every person to choose the food they love. Often overlooked by institutions, it is within situated practices, dishes, and networks of exchange, that much of the existing biocultural diversity is conserved and adapted to changing local needs. As ethnobotanist Aguilar Meléndez argued "most of chile diversity is perpetuated on a local scale through the people that use it" (Aguilar Meléndez et al., 2018; personal communication, 2022). As will be explored next, the meaning and use of chile in a local community can unveil crucial knowledge that has escaped the attention of researchers, policymakers, and the aisles of big international seed banks.

Chapter 5 : The Flavour of Memory

Doña Ernestina Santiago recalled the *guiintabich* as a special part of her diet from when she was young. Now eighty years old, she describes the flavours this chile brought to the local dishes. The *tabiche*, or *guiintabich* in Zapotec, was a spicy and flavourful chile that was widely used in Doña Ernestina Santiago's hometown, the community of Santo Domingo Tomaltepec in the Central Valleys of Oaxaca, Mexico. Whilst remembering the *tabiche*, Doña Ernestina Santiago recalled not only its spice, but also her childhood, her mother and sister, and how they used to cook for her. In this sense, the memory of *tabiche* sparked much more than just a flavour. Like her, older women remember the role this chile played in their everyday life when they were young; also, it served as a reminder of the ones that had parted since. Generally cooked in salsas or fresh with frijoles, the chile *tabiche* was grown and harvested in the community's gardens, but also largely found in regional *tianguis* or markets. More recently, the chile *tabiche* was displaced from the plots and kitchens of Santo Domingo Tomaltepec, alive only in the memory of some older habitants. This changed when an open and collaborative process between town members, the project Cocina Colaboratorio, and the author brought the *tabiche* back, from memory to the kitchen table, in the period of July 2021-June 2022.

Chile's significance is not a single and defined construction. As analysed so far, different actors in this story – such as agricultural scientists, ethnobotanists, anthropologists, stakeholders, and policy makers – have suggested diverse, often contradictory, approaches to the value of this crop and its symbolism. This was evidenced in Mexico's twofold approach of continuing paternalistic food security policies whilst also aligning with international discourses on food security, sustainability, and biocultural heritage. The overall priority of the state remained the mass supply of basic foodstuffs, not the boost of regional food pathways.

The implementation of strategies to protect Mexico's biocultural heritage and food security were thus tied to the idea of nationhood – of a "genetic heritage" (as cited in SINAREFI's government webpage), leaving aside the value and knowledge of many people who actively use and safeguard crop landraces.

This chapter will add another layer – and a very spicy one – to this work. It provides a local account of chiles in the community of Santo Domingo Tomaltepec in Oaxaca, Mexico, within a local food sovereignty project, Cocina Colaboratorio. As such, it turns to how chiles have been conserved and perpetuated through everyday practices, cuisine, memory, and community life, and why these are pivotal for the continued existence of biocultural diversity. As shown in the histories of the last chapters, institutional chile crop conservation projects remained surprisingly limited despite punctuated efforts from academics to integrate local knowledge into their agendas. The political contradictions, lack of funding, and the neglect of actors such as small farmers and peasant communities, however, led to the organisation of other types of action beyond institutions and academic halls.

The emergence of a variety of food sovereignty projects in the 1990s and 2000s, such as El Parque de la Papa in Perú, Sin Maíz no hay País in Mexico, and La Via Campesina globally, reflected long standing frustrations towards political leaders of international organisations and states to tackle urgent matters like climate change, the homogenisation of food systems, and growing socioeconomic inequalities. In parallel, growing interest in culinary traditions and their links to biodiversity emerged in initiatives like the Slow Food Movement and in feminist academic writing, where the kitchens emerged as sites of knowledge, empowerment, and resistance (Abarca, 2006; Cárdenas-Marcelo et al., 2022; Christie, 2008).

From the late 1990s and early twenty first century, there has been a boom in biocultural heritage initiatives, yet these institutional efforts at conservation most often overlooked situated types of knowledge, especially that of peasant and indigenous women. Despite the long history of systematic rural abandonment under capitalism and dispossession, local practices around food networks have persisted in communities around the world. There is still much to tell, to remember, to protect. In many regions of Mexico, heirloom seeds are cultivated every season; they are grown and eaten. Handmade tortillas are still a favourite, local markets are significant points of encounter and exchange, and local chiles are the main

flavour-givers of traditional recipes. Networks of use and exchange keep heirlooms and heritages alive (Roldán Rueda et al., 2016). This resilience speaks of something which crop conservation science, agricultural policies, and food security strategies have historically ignored: sites of conservation and sustenance can be found in everyday activities and spaces, such as in kitchens, public spaces, celebrations, in cooking a *salsa,* and in remembering childhood flavours, places, and people. It is though the seemingly mundane life that broader dynamics such as cultural and environmental change are revealed.

The chapter is structured as follows. First, I will provide an account of how culinary knowledge, gender, taste, and memory have been analysed in previous literature. Consequently, I will detail and set the intellectual background and history of Cocina Colaboratorio. This will give the reader a good idea of the methodology employed during fieldwork, especially concerning the conversations and participatory events. Then I will fully dive into the work undertaken in Santo Domingo Tomaltepec around chile, and the specific actors that were involved in the process. Here, I explore chile within different narratives of belonging, memory, loss, imaginary futures, as well as through embodied practices and active cooking. Lastly, I will link this with the participatory events that took place in Santo Domingo Tomaltepec and show how these collective approaches – between local knowledge, academia, and art – can spark community action and organisation. The main participants and collaborators were a group of women cooks or *cocineras*, all of whom I will properly introduce, who are part of Cocina Colaboratorio collective. These women shared their insights, trust, stories, time, and affection with me and with the rest of Cocina Colaboratorio's team. As I repeat more than once throughout this text, without them, this work would not be.

Background: Remembering, Knowing, and Doing from the Kitchen

The project Cocina Colaboratorio (to be referred to as 'Cocina') originated in 2018 when a group of artists and researchers, namely Mariana Martínez Balvanera, Patricia Balvanera Levy, and Elizabeth Guerrero Molina, alongside local communities, first Loma

Bonita in Chiapas, and followed by Santo Domingo Tomaltepec, Oaxaca, and Xochimilco, Mexico City, joined concerns around biocultural diversity loss and the need to collaborate to improve local food systems. Cocina's strategy consisted of bringing interdisciplinary studies, activism, and community building to the kitchen table to promote dialogue, exchange, and action. By zooming in on this collective, I will develop an analysis of the centrality of women's culinary knowledge and systems of care in conserving crop diversity. In this final chapter I will insert myself as a researcher in the historical thread of this dissertation, which started in the 1970s with INIFAP's first chile explorations in chapter two. That is, I will both tell a story and be part of it, making it clear that the objective will not be to separate myself as an external observer. My collaboration with Cocina is, in this sense, using tools such as participatory action research, oral histories, and socially engaged art, which serves as a response to what, so I have argued, had been missing from institutional conservation and food security efforts.

Therefore, this chapter is both an addition to previous histories of women in conservation, and a potential "next step" within this story of how to enact change in food systems. This call to action, of course, is situated under a specific framework and is shaped by the project's background and members' trajectories, as will be delineated. Yet, I believe it speaks to broader and more general concerns and social movements around the world which have sought the creation of alternative food networks, most of which have reacted to the growing standardisation of foodstuffs within globalised markets, the precarity and exploitation of industrial agriculture labour, the inequalities experienced by rural communities, the neglect of gendered knowledge, the loss of cultural and biological diversity, and more.

This chapter builds on recent scholarship, mainly from Latin America, concerned with making visible the so-often invisible labour that women undertake in sustaining life and, in particular, food systems. For one, critical heritage scholars such as Sarah Bak-Geller, Charles Edouard de Suremain, and Raúl Matta (2019) have underlined the need for complicating notions of heritage as something intrinsically good. In constructing a given heritage, or defining what it is composed of, there will always be processes of negotiation, of competing interests, and of tensions in defining what or who fits into a patrimony, or not. What gets to be named as "authentic" or "original" and by whom? As shown in the previous chapter, big

institutions like SINAREFI or even UNESCO, have often accommodated the heritage framework within a context of agricultural markets, food security urgencies, and international pressure, which has sometimes placed the economic benefits of these policies outside the reach of small producers, crop guardians, and seed keepers.

Yet, Bak-Geller (2019) argues that in some cases, where local appropriations of heritage are undertaken and shared by communities themselves, the notion can also lead to political leverage towards communities' self-determination. Food, as a major component of identity, is a primary avenue in which to define, re-appropriate, or construct heritage. Food shapes our senses of belonging (Jordan, 2015). By discussing the case of Coca in Jalisco, Mexico, Bak-Geller explores how the concept of heritage can be used by local communities as a political currency; one which only makes sense if contextualised within current global market-based and neoliberal economies (Bak-Geller, 2019). Here, Back-Geller shows how Coca habitants were able to enact more political representation with the state and demand territory rights by fabricating their culinary repertoire and reappropriating their indigenous identity. This recognition of community political agency and outsiders' respect for their own process of (re)appropriation has been fundamental for the ethical and research guidelines of Cocina Colaboratorio, as will be explained shortly.

Previous literature has recognised that cultural elements, such as language and taste preferences, have played a vital role in the diversification and conservation of biodiversity as early as 1970, especially in ethnobotany and agroecology (Aguilar Meléndez, 2006; Hernández Xolocotzi, 1970, 1981; Toledo, 1995, 2001). Yet literature regarding the role of women and their own knowledge is fragmented and divided and, generally, poor except for the link between gender and agriculture or rural development (Bock & Shortall, 2006; Howard, 2003; Sachs, 1998). However, women's role in diversifying and conserving biodiversity goes well beyond agriculture (Howard, 2003, p. xvi). Domestic spaces such as the garden and the kitchen have been historically overlooked by science as sanctuaries of knowledge and diversity.

From the 1980s, however, feminist literature has highlighted the household and its gendered dynamics as spaces worthy of research to understand the transmission of knowledge and women's welfare within family relations (Arizpe, 1989; Friedmann, 1992;

Hayden, 1981). Yet, approaches from the social sciences have struggled to fully integrate spaces regarded as intimate and enclosed such as kitchens, with a few exceptions. As Maria Elisa Christie points out, an "anti-kitchen bias" in research and the lack of diversity in current studies – mostly based on the perspectives of white, Anglo, middle-class and Western subjects – has limited our understanding of the "private" and "public" and the way culinary knowledge and women navigate these spaces (2006, p. 654).

Kitchens as sites of knowledge and biodiversity conservation have been mainly explored in food and memory studies within anthropology, sociology, and ethnobotany (Abarca, 2006; Aguilar Meléndez et al., 2018; 2021; Christie, 2008; Nazarea, 1998; Pérez-Volkow et al., 2022; Vizcarra Bordi, 2006). Therefore, whilst some consider the kitchen as a sort of imprisonment for women, others have signalled the complex dynamics of kitchens, women, empowerment, community rhythms, and *fiesta* (Christie, 2008; Hayden, 1981). Celebrations in many communities of Mexico involve cooking both inside and outside the household, and both individually and collectively – in scenarios where mostly women hold the knowledge and authority (Christie, 2006; 2008). Without romanticising or ignoring the patriarchal systematic oppressions of gender roles, it is important to look deeper into how culinary practices in many non-western communities are also a source of personal self-determination, of community building, of cultural transmission, of caring, of conservation, and of belonging. As food expert Meredith E. Abarca (2006) defines it, the kitchen can be a woman's *space*, not always or necessarily their *place*.

The processes that take place in the kitchen, as well as the resulting flavours and experiences, are part of the *saber-hacer,* or know-how, of the *cocineras* of Santo Domingo Tomaltepec and of many regions in the world. Through *saber-hacer*, each cook develops their own particular *sazón*, stemming from learned practices, experience, and their own sensorial faculties. The *sazón*, then, refers to a person's own seasoning, but expands to include the *saber-hacer* involved in the process of creation – the expert's hands. As many of us may know, we can learn our grandmother's recipes, but we will seldom replicate their *sazón*. Through their teachings and time, we can then create our own.

This type of knowledge, or how the bodies *know*, reveals an epistemology that involves all the senses, and that is often not expressed or even possibly conceptualised in

writing. As discussed in the introduction, Western philosophy has historically placed embodied knowledge or *saber-hacer* as a separate, and inferior, modality of knowledge in contrast to the mind (Burkitt, 1998). That is, the "head work" is often regarded as valid or objective whilst the "hand work" has not merited such degree of recognition (Heldke, 1992). Despite growing anthropological research that highlights their threaded and combined nature (Marchand, 2010; Stoller, 1989), a binary and hierarchical approach still informs much academic thinking. This chapter will build on accounts (Abarca, 2006; Heldke, 1992; Stoller, 1989) that look past this dichotomy to consider cooking and *sazón* as both theoretical and embodied endeavours that inform each other in the process of creation.

More so, the actions of care, or *cuidados,* such as cooking and nurturing the household, have been described as systems that sustain the very foundations of life as we know it (Vega et al., 2018). These same activities have been framed in feminist theories as the engine of capitalistic societies which exploit unpaid home labour. Scholars have begun to refer to 'systems of care' as an analytical framework whereby a range of layers of provision intersect, such as the state, the market, and the family unit. (Vega et al., 2018, p. 16). Here, aspects like food, housing, healthcare, water, land, and public space are inevitably intertwined with the access to these systems of care, and with how they are enacted. Recent feminist approaches from the Global South are expanding the topic by integrating collective and community ways of life, where the politics of care are lived and materialised differently than in urban-Western metropoles (Greenberg, 2003; Morgan, 2010; Pérez-Volkow, 2022; Vega et al., 2018, p. 13; Vizcarra Bordi, 2006).

These scholars have proposed the study of care systems as a relevant tool to unveil how colonial, patriarchal, and capitalist legacies have shaped the racial, gender, and socioeconomic hierarchies that compose present-day realities in Latin American societies. They remark that attention to care systems allows us to consider affective components, ones that visualise concrete actors (such as indigenous and racialised women and migrant groups), their context, and their relational dynamics (Vega et al., 2018, p. 23). Moreover, they suggest that the study of *cuidados* in community settings can illuminate how modalities of socialisation and collective attention/nursing of people are maintained by women through family alliances, reciprocity bonds, *fiesta* or celebrations, and the *tequio/minga* or community

work (Segato, 2011; Vega et al., 2018, p. 30). The ways in which the women of Santo Domingo Tomaltepec handle, plant, cook and eat chiles, reflects a complex network of care, belonging, identity, heritage, and embodied practices, and knowledge that sprout from a specific relation with their shared territory.

Chiles confer much more than the material flavour to traditional dishes. Chiles add and connect with an intangible element of the livelihoods of Santo Domingo: memory. Chiles evoke from women a belonging to territory and most of all, parted loved ones, as sensual vehicles that allow connection to feelings beyond the actual experience of taste (Sutton, 2010). Chiles' value here accounts for the diversity they bring to food but also for the personal and collective stories, imagination, emotions, and cultural belonging they trigger. Memory then is crucial to understand the meaning of chile, and vice versa, in the community of Santo Domingo Tomaltepec.

Scholars such as Jennifer Jordan (2015) and Virginia Nazarea (2005, 2006; Nazarea & Gagnon, 2021) have touched on the importance of cultural memory for biodiversity conservation. Nazarea remarked how cultural memory, which is often memory in use, allows people to resist industrial agriculture and monocultures "by continuing to nurture a wide variety of species and varieties in their home gardens and their fields, sustained by sensory recollections regarding the plants' aesthetic appeal, culinary qualities, ritual significance, and connection to the past" (2006, p. 325). In a similar vein, Jordan touched on how edible memory has sparked seed-saving movements in the US. These preservation efforts, she argues, have been fuelled by more than the sole motivation of conserving biodiversity; namely, the remembrance of childhood flavours, shared stories, and heirloom varieties that have meaning through the memory of people (2015, p. 17).

Some academics have argued that memory is not 'History' (Weissberg, 1999). The narratives I recount in this chapter use memory to create a story and develop an argument, and thus I seek no strict objectivity. Rather, my take on memory is aligned with the creation of narratives and stories that allow a counter to hegemonic histories, neglected heritages, and marginalised ways of knowing. Memory is valuable because it is tied to "webs of socialities, landscapes, and mythologies that call forth complex itineraries and sanctuaries" (Nazarea & Gagnon 2015, p. 7). Memory might not be historically "objective", but its constant

construction allows for the creation of pasts that secure the present and for imagining more hopeful futures. Like heritage, memory enables the fortification of identity, and can be a powerful tool of action towards community agency and self-determination. Chiles, as sensual ingredients that trigger embodied sensations (Petrick, 2022), touch not only palates but affective fragments of who we are, what we like, who/what this connects us with, and who we want to be. Memory can often be accompanied by intention. When Doña Ernestina Santiago remembered the chile *tabiche,* her nostalgia sparked an interest in her to know more about this chile.

In this context, flavour and taste in this chapter will not be used as an analytical tool to explore the actual sense of tasting, or to describe how given traditional dishes should taste, but rather as a vehicle that transports individual and collective memory and senses of belonging, and, more so, actions that allow the existence of diversity. Whereas indigenous women and their culinary knowledge have not been recognised as sites of conservation by academia, their practices, *cuidados* or actions of care, memories, and everyday experiences in the kitchen sustain a lot of what we so eagerly write about: seeds, diversity, legacies, situated and embodied knowledge, and more.

It is within these theoretical frameworks that the story of chiles in Santo Domingo Tomaltepec within Cocina Colaboratorio brings something relevant to the table, quite literally. Through the depiction of individual and collective narratives, I will account for chiles in Santo Domingo Tomaltepec, their movement in time and space, their varied meanings, and the peculiar case of loss and recovery of the chile *tabiche* as a collective endeavour with community habitants and Cocina Colaboratorio. By exploring how women cooks and habitants of Santo Domingo Tomaltepec assign value to chile, as crops, as ingredients, and as elements of memory, I will argue that aspects such as affection, systems of care, embodied practices, nostalgia, taste, and community life, are just as valid and necessary for defining and defending heritages and territories as the resource-based visions usually employed by institutions and conservation programmes (Fenzi & Bonneuil, 2016), and even more so, because these everyday actions are also political. In this sense, this story aims at expanding the horizon of the history of crop conservation by stepping into the kitchen, considering it as a hub of knowledge, collectiveness, and action.

The co-creation of narratives in this story did not come without challenges, and these have limited and defined the scope of this work. Firstly, establishing bridges of trust, bonding and listening, and acknowledging different positionalities, which inevitably entail power and privilege differentials, sometimes led some stories not to be told, or to difficult encounters. The personal and emotional involvement of all actors inevitably biased and shaped the representation of events. Yet, this work is not focused on discussing historical truths,[1] as it is also not aiming at telling a story of chile extinction or the inevitability of resource erosion. This chapter highlights the types of knowledge that generally lie in the shadow of scientific or institutional structures. It focuses on showing how day-to-day actions like cooking, remembering, telling a story, sitting around a table, can be powerful motors for biocultural conservation and sovereign food systems, especially within farmer and indigenous communities.

Cocina Colaboratorio: The Kitchen as a Place of Exchange, Creation, and Action

Social concerns around globalisation and the solidification of neoliberal policies throughout the 1990s underpinned world-wide opposition movements at the turn of the millennium. These groups, examples being the Global Justice Movement and the Alter-globalisation movement, called for an equitable distribution of economic resources and underlined the need to tackle the long-standing power division between the Global North and the Global South. Within their calls, food systems emerged as a focal point of action (Gravante, 2020).

As detailed in the last chapter, Mexico's food system was largely shaped by NAFTA and based on the importation of grains and the exportation of exotic crops, increased inequalities and food insecurity in most marginalised and impoverished urban and rural areas (Rubio & Pasquier, 2019). As the state's role in improving food security remained dissatisfactory at best, social discontent, and growing concerns about the conservation of

[1] For an extended discussion on History and truth see Behan McCullagh (1997), Haecker (1985), Shapin (1995), White (2001).

biocultural diversity mobilised local communities, academics, and activist groups towards the formation of collectives that responded to these crises.

Cocina Colaboratorio is a transdisciplinary research and incidence project that focuses on attending to arising issues on food systems of Mexico, such as the loss of biocultural diversity, soil erosion, the availability and quality of water, small-scale agriculture, waste management, food sovereignty, climate change, and the standardisation of diets (Mesa-Jurado et al. 2024). Created in 2018, Cocina is part of a wider surge in situated social and academic efforts in Mexico and abroad that have sought to strengthen local food systems for the past two decades. Bringing together and bridging knowledge from local communities, environmental sciences, social sciences, and art, these growing efforts have diverged from solely academic research projects and from institutional initiatives insofar they integrated more explicit avenues of action, resistance, and political incidence (Bala, 2012; Dekker, 2017, 2018; Helguera, 2011; Thompson, 2012; Tsekleves et al., 2021; Tuhiwai-Smith, 1999). Examples of these are the Food Art Research Network (FAR), Green Art Lab Alliance, and in Mexico, Colectivo Ahuejote, Mercado Alternativo, Projecto Parutz', Cultiva Alternativas de Regeneración, amongst others.

Cocina Colaboratorio emerged as a prototype for creating more diverse and sustainable food systems by using mobile kitchens in public spaces as sites of action. The first pilot took place in the community of Marqués de Comillas in the Lacandon Jungle in Chiapas, Southern Mexico, a relatively recent migrant community largely struck by environmental erosion. Here, the project first proposed the kitchen, and the collective sharing in it, as a space where it is possible to interconnect, discuss, experiment, and find alternatives for one or more aspects of local food systems; from agroecological and sustainable cultivation, networks of seed conservation, collective decision-making, communitary cooking, re-appropriation of heritages, community building, intergenerational learning, and more.

Cocina Colaboratorio first consisted of a collaboration between Cascoland (an international collective based in the Netherlands that centred on the development of socio-ecological sustainable societies), the Wageningen University's Forefront Program focused on agro-forest landscapes, the project Recovering Biodiversity, Ecosystem Functions and Services from the National Council for Science and Technology (CONACYT), and researchers

from the National Autonomous University of Mexico and the Colegio Frontera Sur (ECOSUR). For six weeks, the nascent project set up mobile kitchens, which involved the collective installation of itinerant kitchens alongside participatory cooking sessions, where the local population shared stories about their food pathways and culinary traditions whilst tasting local dishes and flavours. This pilot implemented perspectives from the arts to design spaces and communication tools that sought to strengthen community building and agroecological practices.

When the Dutch team returned to Europe, Cocina Colaboratorio matured into an independent project in 2020. Mexican collaborators, in particular artist and designer Mariana Martínez Balvanera, ecologist Patricia Balvanera Levy, soundscape artist and sociologist Elizabeth Guerrero Molina, and local actors in Chiapas, sought to establish a more equal distribution of decision-making processes and a more horizontal power distribution that would consequently create more responsible bonds, as well as the bridging of knowledge between local habitants and project members (Emilio Hernández Martínez, personal communication, 2022).

Together they materialised this vision by obtaining funds from UNAM's Support Program for Research and Technological Innovation Projects (PAPIIT) for the period of 2020-2022, and later, from the National Strategic Programmes (PRONACE) by CONACYT for 2021-2024. This funding enabled the expansion of the project to three sites and the integration of more collaborators, mainly based in Mexico, including sociologists, anthropologists, ecologists, environmental scientists, chefs, historians, artists, and local community members. The three communities included Loma Bonita in Chiapas, Santo Domingo Tomaltepec in Oaxaca, and Xochimilco in Mexico City, with each responded to contrasting socio-ecological challenges in rural and/or urban settings, histories, culinary traditions, and food politics.

From this phase onwards, Cocina's intellectual and theoretical foundations solidified, building on frameworks from Socially Engaged Art (Helguera, 2011), particularly site-specific social design, Participatory Action Research (Fals Borda, 2022; Fals Borda et al., 1986), and *Comunalidad* or Communality (Luna, 2015). The project thus transitioned from a European-based vision of transdisciplinary collaboration towards a Latin American-informed one, where areas like sustainability science, art practices, and local and indigenous studies already had a

trajectory of their own. That is, the project sought to enhance social action within food systems without directly interfering with a community's wishes, rhythms, or structures.

Moreover, ethical protocols were implemented for all collaborations and fieldwork. These were constructed based on decolonial and intersectional critical feminist works such as "Decolonizing Methodologies: Research and Indigenous Peoples" by Linda Tuhiwai Smith (1999), "Native Studies Keywords" by Stephanie Nohelani Teves and colleagues (2015), "Braiding Sweetgrass" by Robin Wall Kimmerer (2013), and the "Code of ethics for research, research-action, and ethnoscientific collaboration in Latin America" by the General Assembly of the Latin American Society of Ethnobiology (2018). All of these underline the necessity of deconstructing Western colonial pasts (still present in academic work), of acknowledging dynamics of power engrained in different socio-political backgrounds, and the importance of respecting a community's privacy, ways of life and knowing, and their decision making.

Specifically, Cocina's ethical protocols focused on minimising the superiority gap and the extractivist practices between researcher and community participants, dynamics that are still common in fieldwork both in the social and natural sciences given the power and authority of science in the past three centuries (Gal, 2021). These protocols were established as: a preparatory period where new participants were invited to familiarise with the site's cultural context and time to develop a two-way recognition between researchers and the community (before any research is undertaken); a strict consent rule where participants expressed honestly and clearly their research goals, their intentions and potential future publications; attendance to group work and collaborative events even when activities do not match an individual's research goals; the acknowledgment of one's socio-political positionality and thus absolute respect for local lifeways; and a "seed" or activity/workshop/encounter/product to give back to the community as a way of showing gratitude over their time and disposition.

The organisation of each site is led by a team that consists of an art coordinator, an academic coordinator, and a local coordinator. Moreover, each site has a transdisciplinary collective of food producers, *cocineras*, local authorities, academics (biologists, sociologists, economists, historians, environmental scientists, agricultural scientists, architects, anthropologists, and more), artists, designers, and collaborators from other collectives. This

amounts for approximately a hundred people in total for the three sites (Mesa-Jurado et al. 2024, p. 218).

The project's lines of action are structured into "arenas" or strategic avenues of action (Figures 5.1 & 5.2), where collective reflection and the "preparation" of desirable futures take place (Kooi & Martínez, 2021). Interconnected around the kitchen, arenas can be symbolic or material spaces of encounter, dialogue, and experimentation, where collective knowledge is exchanged amongst community members and Cocina's collaborators. Arenas are mediated by creative practices, where the logistical, spatial, and affective conditions are generated to facilitate engagement and dialogue. The objective is to enact spaces of inspiration that reflect how everyday activities such as cooking, planting, walking, community work, to name a few, contain the rhythms, practices, dynamics, and knowledge of a territory.

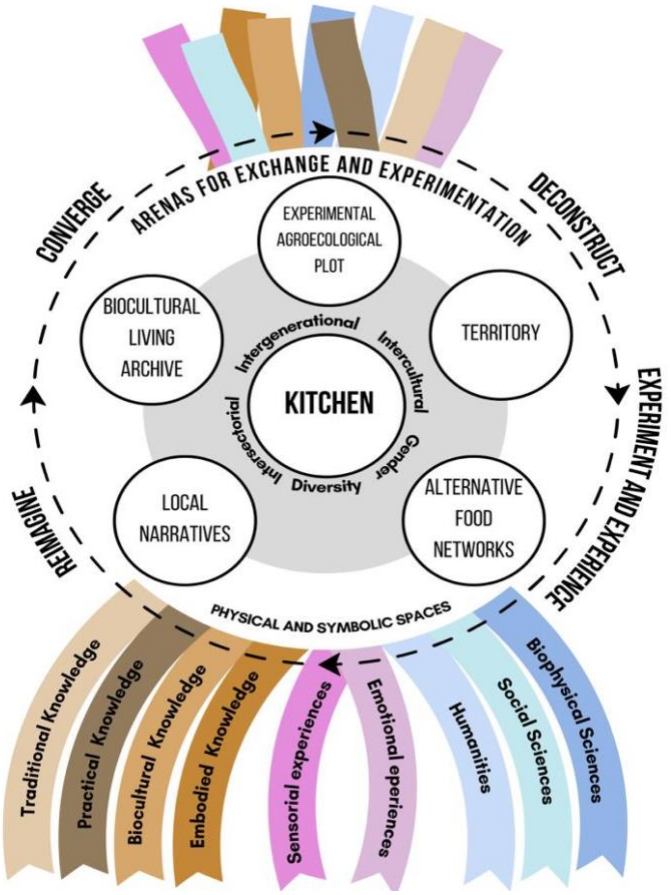

Figure 5.1 *Figure of knowledge co-production by the design of tools around the kitchen as a collaborative metaphor (Azahara Mesa-Jurado, 2024, in review).*

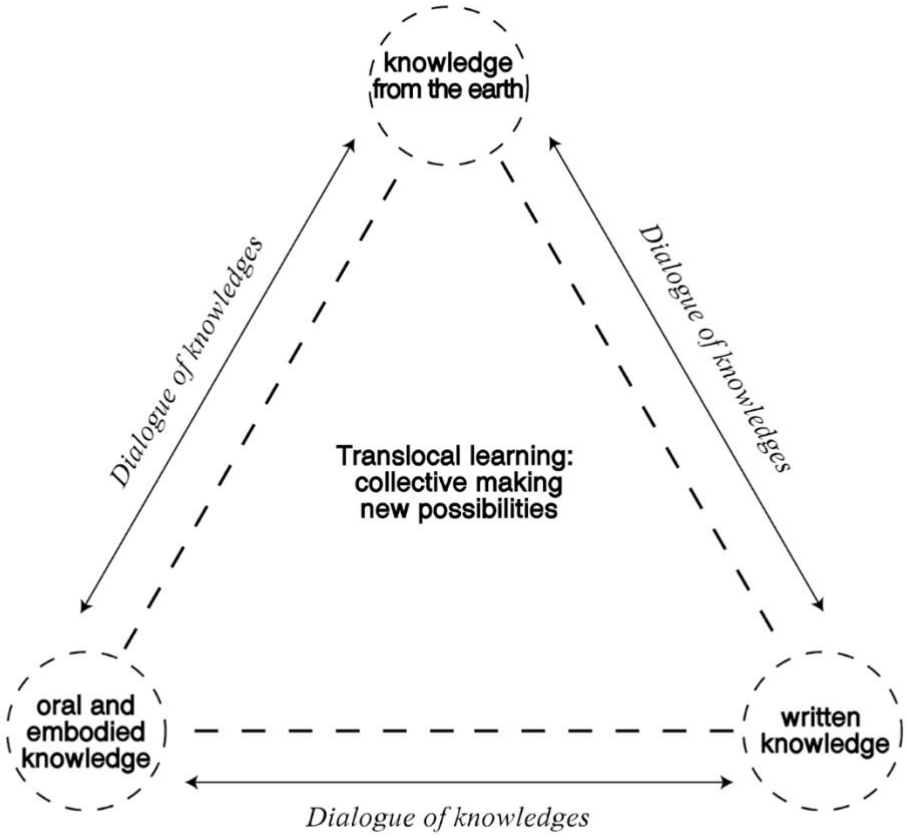

Figure 5.2 *Diagram of Cocina Colaboratorio's approach to the collective co-construction of knowledge(s) (Emilio Hernández Martínez, 2023).*

Parting from the explicit interests of community actors, arenas (Figure 5.3) become longer collaborative methodologies and research processes that seek to inspire alternatives and create a space to collectively think of possible solutions, innovations, actions, tools, or agreements towards a better food system – whatever that may mean for each community. As such, arenas change and evolve with time, as can their aims and scope; they are articulated by the collective's decisions and, as such, activate or generate new visions and actions as they are constructed. To date, three main intersecting arenas have been established and are still ongoing in Cocina Colaboratorio: the kitchen, the plot or parcel, and the Living Biocultural Archive (LBA). The kitchen is the centre of the three, and consists of both domestic and public

spaces, where tools are created for collective exchange, culinary conservation, and innovation. The plot focuses on implementing agroecological strategies for food production and takes place in family and public parcels (such as school or community plots). The LBA started in 2021 as a strategy to collect, compile, conserve, and perpetuate the biocultural heritage of the three communities; such as the living knowledge, practices, seeds, soils, narratives, stories, and more.

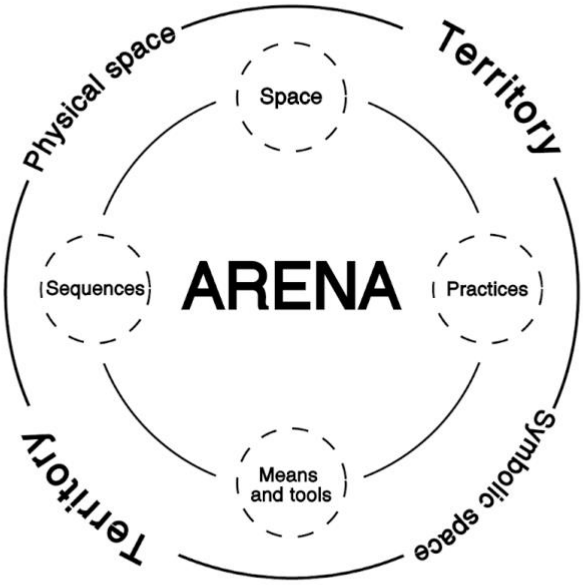

Figure 5.3 *Arenas of Cocina Colaboratorio (Emilio Hernández Martínez, 2023).*

The LBA was first framed as a living, mobile, and adaptable set of devices, community actions, and sanctuaries or containers such as public spaces, house gardens, plots, or *milpas* (Nazarea & Gagnon, 2022). Using critical museology, which is an art-based social movement that challenges the often hierarchical and inaccessible format of galleries and museums to

share art (Shelton, 2013; Lorente, 2022), the LBA sought to establish a "living archive" in opposition to centralised institutions such as archives or seed banks, where documents and seeds remain locked, and access limited to a few. In this sense, the LBA sought to collectively interweave systems of care and exchange to perpetuate the diversity, knowledge, memory, and practices that matter to a community – with action rather than storage as its objective. This effort aimed at transcending institutional halls by focusing on the movement and practices that exist in seeds, house-gardens, bodies, flavours, memories, and affections. Today, the LBA is particularly strong in Santo Domingo Tomaltepec, where the community has defined three main avenues to work on: culinary heritage and traditions, agricultural production and crop diversity, and Zapotec language and histories of the town.

Examples of the encounters and activities that have materialised through the arenas of Cocina include the creation of "Radio Cocina", which has focused on compiling stories and exploring the communities' soundscapes, public culinary encounters, *tequios* or collective work sessions, co-construction of communal kitchens, culinary innovation workshops, town biocultural *calendas* or parades, seed exchange fairs, and more. More so, the arenas have facilitated the creation of local groups of action with common interests that meet regularly to address a certain issue. For one, the Community Chroniclers, a group high school students of Santo Domingo Tomaltepec, support the LBA by creating audio-visual content to document their community's lifeways. Also, the agricultural group of "*Las Caracolas"* or "The Shells" in Santo Domingo Tomaltepec, a group of women interested in learning about agroecology who collectively support each other's plot through teamwork or *tequio* (Figures 5.4-5.8).

Cocina's arenas and projects have promoted multilateral conversations and dialogues between a diverse set of participants. Very importantly, these initiatives have enhanced the revitalisation of local food pathways and intergenerational exchange in Loma Bonita, Santo Domingo Tomaltepec, and Xochimilco. This weaving of diverse backgrounds, interests, and needs, has materialised in diverse paths of action in each territory, also unveiling the challenges of community building. Some of these have included the difficulty in reaching consensus due to competing interests, promoting local participation, the lack of funds, creating equal power dynamics between the range of participants, questioning tradition to innovate, amongst others. Yet, all these learnings and experiences have solidified the

project's ultimate goal through the years: that of strengthening community agency, where local actors can become the stakeholders of the future of their communities and their food chains.

Figure 5.4 *Community chronicler Manuel Juárez and Cocina Colaboratorio collaborator Elizabeth Moreno interviewing historian Martha Martín Gabaldón about the ancient history of Santo Domingo Tomaltepec (Emilio Hernández Martínez, 2023).*

Figure 5.5 *Merma or food surplus cooking innovation event in Xochimilco, Mexico City (Rubén Garay, 2021).*

Figure 5.6 *Co-construction of a community oven in Loma Bonita, Chiapas (Ruben Garay, 2021).*

Figure 5.7 *Left, Doña Inés Ramírez with a pot of tamales after an intergenerational tamales cooking session in Santo Domingo Tomaltepec, Oaxaca (Daniela Sclavo Castillo, 2023).*

Figure 5.8 *Right, tequio or community work session in the agroecological plot of Josefina Hernández (in picture) and Taydé Martínez (Daniela Sclavo Castillo, 2021).*

It is within this framework of Cocina Colaboratorio that my research on chile took place in Santo Domingo Tomaltepec in the summer of 2021, December 2021, and the summer of 2022.[2] The objective, as discussed and agreed with the collective, would be to trace and explore chile's value, meaning, changes, narratives, and stories through semi-structured conversations and group activities. An equally important aspect of my presence and work would be to actively engage in collaborative encounters, to take part in and contribute to wider project events, to give back "seeds" or tokens of gratitude to the community (as quality time, planned encounters, sharing research results), to always be honest and clear about my research intentions, and to carefully observe, listen, and bond with the community's rhythms

[2] My collaboration in Cocina Colaboratorio continued through the Grant "Imagining Futures" by the University of Exter through 2023 and 2024, which focused on expanding the LBA.

with absolute respect. That is, from the planning stage it was set that I would not only write stories or "collect data" on my own but rather engage in the co-creation of histories, enacting them in community-building and participative activities. In this sense, caring for and bonding with the people I worked with seemed the natural and decent choice; and as such I describe my participation not from an "outsider's view", but as an active component of the story. In all conversations and encounters, explicit consent was asked for all types of documentation, namely written notes, pictures, videos, or recordings.

The main group of people I worked with during this period were expert women cooks or *cocineras,* and their daughters and granddaughters or family members. These are Doña Inés Ramírez Martínez, her daughter Marcela Cortés Ramírez, and granddaughters Elisa Pérez Cortés and Cynthia Pérez Cortés; Doña Ernestina Santiago Bautista and her daughters Magaly Pérez Santiago and Lizbeth Pérez Santiago; Josefina Hernández López, her husband Juan Carlos Reyes Ramírez, and her aunt Taydé Martínez Antonio; Felicitas Robles Martínez; Carmen Santiago Martínez; Carmela Canseco, her daughters Virginia García Canseco and Chepina García Canseco her granddaughter Paola Miguel García, who collaborated actively in the story that follows. Ranging in age, profession, life history, and *sazón*, each of them related to local food with a different perspective and sense of belonging. Yet, their knowledge and embodied *saber-hacer* had a lot to say both from a personal and community perspective about Santo Domingo Tomaltepec's chiles and their relation to the complexities around food, culture, and biodiversity.

Women and Chiles of Santo Domingo Tomaltepec: Flavours, Hands, Memories

It was almost sundown on the 1st of July 2021 when we arrived at Santo Domingo Tomaltepec, Oaxaca. The mountains stood high on the town's edges, and the smell of freshly baked bread captured the first moments of our arrival. The encounter was not all about chiles: as established by Cocina's ethical protocol, first it was about mutual recognition, trust, and understanding between the community, Cocina Colaboratorio, and myself. An invitation to set the kitchen table through a dialogue of knowledge – both literally and metaphorically.

Without these, unveiling chile's role in Santo Domingo's life would have been certainly difficult, and above all, shallow. This following section will contextualise Santo Domingo Tomaltepec. Then, I will describe chile's role, uses, and meanings in the hands of both young and older women of the community. Finally, through the story of the loss, memory, and re-encounter of the chile *tabiche* I will show how the co-construction of narratives and the use of collaborative and participative methods can be useful to the history of science and more broadly, to reflect on current food systems and crop conservation. In doing so, I will detail fragments of the encounters shared with Doña Inés Ramírez, her daughter Marcela Cortés and granddaughter Elisa Pérez, Doña Ernestina Santiago and her daughters Lizbeth Pérez and Magaly Pérez, Doña Felicitas Robles, Carmen Santiago, Carmela Canseco and her daughter Virginia García and granddaughter Paola Miguel, and Josefina Hernández and Taydé Martínez – all of whom hold extensive culinary knowledge (each of them in their own ways) and who were open to collaborate and share insights of their home, culture, memory, and imaginary futures.

Santo Domingo Tomaltepec: Zapotec heritage, mountains, and celebration

Santo Domingo Tomaltepec is located in the central Valleys of Oaxaca, a territory of Zapotec Dizdá[3] and Mixtec heritage that holds an ancient history of crop diversification and culinary traditions (Image 9). The region is known as one of the hubs of maize domestication. Archaeological evidence from about 5-6 millennia before the present suggests that Tomaltepec and surrounding areas went from consuming *teocintle* or *Zea perennis*, maize's wild relative, to *Zea mays*, the domesticate we consume today. Making this crop the base of their diet, early inhabitants of the region also consumed and diversified chile, beans, avocado, and squash (Allier, 2015; Casas & Caballero, 1995; Delgado Salinas et al., 2004; Zizumbo & Colunga, 2010). This early history of crop diversification connects to today's rich culinary traditions and food diversity in the whole region. In Tomaltepec, food, seeds, and crops are

[3] Dizdá refers to the self-designation used for the Zapotec language variation in this area of the Central Valleys of Oaxaca.

intrinsically connected to the town's territory (its mountains, valley, and soils) and to its cultural manifestations, mainly the *tequio* (communal work) and the *fiesta* (where the work is celebrated, and the community comes together). Even in its name, Tomaltepec carries the connection of the territory with the crops that have been harvested there for thousands of years. Meaning "the mountain of tomatoes" in Nahuatl (due to the dominion of Aztec peoples before the Conquista), Tomaltepec was known for the rich growth of wild tomatoes in its close-by hills, used in many dishes to date – yet found in much lesser quantities (Martín Gabaldón, 2022).

Following the Mexican Revolution of 1910 and the subsequent land reform, Tomaltepec was granted its current *ejido*[4] lands in 1925 and its communal lands in 1942. As such, today the town holds three different types of authorities: the communal, the *ejidatario*, and the municipality. Like many of Oaxaca's approximately 19 ethnic groups, where communal organisation has been perpetuated despite centuries of colonial and nation-building endeavours, Tomaltepec's governance is based on community principles. This form of socio-political organisation, referred to as *usos y costumbres,* or common law*,* is a set of situated cultural norms that have been edified since pre-Hispanic times by different indigenous groups in Mexico (Segreste, 2019). In Oaxaca, *usos y costumbres* was officially recognised by the state in 1995 which was integrated to the Law on the Rights of the Indigenous People and Communities of the State of Oaxaca in 1998 (Canedo, 2008).

In this sense, life in Tomaltepec is greatly shaped by a sense of communal territory, joint work, cooperation, and communal delivery and governance. Also, as in other Zapotec communities, this town is shaped by principles of reciprocity (González, 2001, p. 16). This is present from family organization to festivities, and from the town' governance to agricultural production and food preparation.

Today, Santo Domingo Tomaltepec (Figures 5.9-5.11) is particularly known for its local traditional sweet bread baking and leather crafts, both generally sold in Oaxaca City some 20 kilometres away. This closeness to the state's capital has allowed a convergence of the rural

[4] Communal agriculture lands held in the traditional system of land tenure that combines communal ownership with individual use. In most cases the cultivated land is divided into separate family holdings, which cannot be sold although they can be handed down to heirs (Britannica 2011). Ejidos where integrated in the Constitution of 1917 as part of the Land Reform after the Revolution.

and the urban in the last decades, which has shaped the town's diets, products, practices and has accentuated the intergenerational gap between young people, who often pursue more urban lifestyles, and older generations, who lead more rural lifestyles connected to the land and agriculture. Yet, the town still harbours its rich and ancient culinary and agricultural traditions, as well as mixed Zapotec and Mixtec heritages, a cultural combination that acquired the local denomination of *Mingano or mingana.*

Figure 5.9 *Territory of Santo Domingo Tomaltepec, Oaxaca (Cocina Colaboratorio, 2021).*

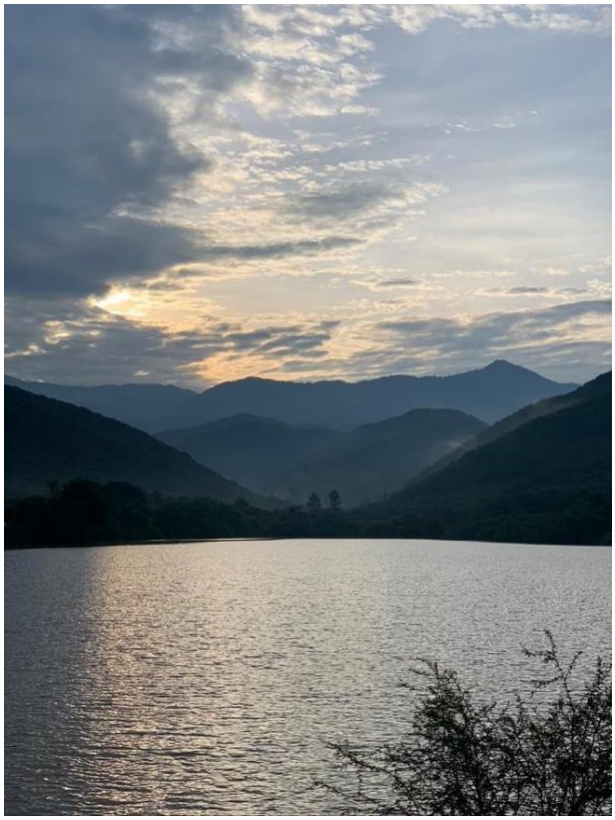

Figure 5.10 *Left, view of Santo Domingo Tomaltepec's main church (Daniela Sclavo Castillo, 2022).*

Figure 5.11 *Right, one of the two dams of Santo Domingo Tomaltepec (Daniela Sclavo Castillo, 2021).*

The relevance that cuisine holds in the community life of Tomaltepec is at the centre of celebrations, work, and social dynamics. Echoing the importance of food, Taydé Martínez, cook and agroecological farmer, expressed that "*la comida es lo básico del pueblo*" or "food is the basis of the town". The main ingredients, namely maize (Figure 5.12), squash, chile, beans (Figure 5.13), tomato, cactus, *quelites* (edible wild plants, Figure 5.14), cacao, eggs, and sometimes meat such as chicken, beef, and pork, come together to produce a wide diversity of dishes.

Figure 5.12 *Maize from Doña Ernestina Santiago's milpa (Daniela Sclavo Castillo, 2021).*

Figure 5.13 *Local beans in the hands of Doña Inés Ramírez (Daniela Sclavo Castillo, 2022).*

Figure 5.14 *Collecting quelites such as chepil (Daniela Sclavo Castillo, 2022).*

On a typical day, one encounters recipes and drinks such as traditional Oaxacan *tlayudas,*[5] stuffed chiles *de agua*, *atole,*[6] hot chocolate, chicken and vegetable broths, *tejate,*[7] cooked cactus, or tacos. On special occasions and celebrations, people eat and cook together dishes like black mole,[8] *higadito,*[9] *chichilo,*[10] *coloradito,*[11]*segueza,*[12] and *tamales* (Figure 5.15). Tomaltepec's cuisine is the centre of life and the meeting point of its inhabitants, from the

[5] Large and crunchy tortillas accompanied by pork lard, beans, avocado, cheese, lettuce, meat, and salsa.

[6] Maize-based hot drink.

[7] Cold drink made of maize, cacao, and *mamey*.

[8] A paste of different chiles, sesame seeds, cacao, broth, nuts, garlic, and more.

[9] Cooked eggs in a chicken and vegetable broth.

[10] A type of red mole made from *guajillo* and *chilhuacle* chiles.

[11] A type of yellow mole with sweet tones.

[12] A chile guajillo-based stew that has bits of tender cooked corn.

private to the public spheres. In most of these edible delights, chile holds an emblematic role in flavour, and as such, in Tomaltepec's cultural expressions and on the inhabitants' sentiments of belonging. These celebration recipes, a collective endeavour, take days and even weeks to prepare, and sometimes are shared by hundreds of people. In this sense, these culinary encounters are significant motors of social cohesion and community building.

Figure 5.15 *Mole tamal and hot chocolate at Doña Inés Ramírez's house (Daniela Sclavo Castillo, 2022).*

Chiles in Santo Domingo Tomaltepec: Desvenando (De-veining) Meaning

Oaxaca is the state of Mexico that holds most chile diversity with approximately 25 chile types out of the 64 existing landraces in the country (Aguilar Meléndez et al., 2018; López López, 2022). In the Central Valleys of Oaxaca, several endemic varieties such as the chile de *agua*, de *onza, palito, pasilla mixe, nanche, chilhuacle, chilcostle*, are fundamental for traditional recipes and are integral to the range of flavours and biocultural diversity of the region. Whilst all these landraces are found and used in Tomaltepec, they are not the only ones. Here, endemic chiles exist alongside other Oaxacan chiles such as the *costeño*, the *tusta*, the *tabiche*, and commercial national varieties such as *guajillo, serrano*, or *jalapeño*. In this sense, the town accommodates chiles that are produced in contrasting contexts: from local and house-grown chiles to regional farming and big-scale industrially produced chiles. More so, chiles are employed in old and new recipes, and are cooked and mixed with a variety of local ingredients such as landrace beans, maize, and *quelites* (the harvest of local milpas) and often also with industrialised ones like sugar, oils, canned products, and others.

Chile in Santo Domingo Tomaltepec stands as the favourite flavour-giver in the food scene of the town. In line with the culinary abundance, each chile holds a specific role (or roles) in the preparation of different dishes; and this is certainly not a simple endeavour. For one, there is the division between fresh and dry chiles, which defines how a chile will be prepared and consumed. Sometimes bought in local stores, fresh chiles are generally grabbed directly from a family's house garden or cultivation plot, where chile plants range from national-wide varieties such as *serrano, chiltepín or piquín*, *jalapeño*, and *habanero*, to local landraces, especially the chile *de agua, palito* and *onza*. When fresh, chiles in Tomaltepec, especially the chile *de agua* – the local delicacy, are prepared filled with chicken or egg, roasted in the *comal*'s ashes, in fresh salsas to accompany food, cut in strips with lemon and onion, eaten raw with beans and a tortilla, or ready to be bitten fresh alongside lunch or dinner.

In contrast, dry chiles are mostly sourced from the Central de Abasto, Oaxaca's biggest market centre, brought from other places in Mexico such as Zacatecas and Tamaulipas, big industrial chile producers (Figure 5.16). These dry chiles, like *guajillo* or *ancho*, are used for

hot stews or moles and are the base for colour and flavour in broths and soups. They are also used in an array of salsas that accompany food. Salsas, made from both fresh or dry chiles, are omnipresent on the town's tables, even when main dishes already contain a significant number of chiles themselves.

Figure 5.16 *Dry chiles at the Central de Abastos (Main Market) of Oaxaca City (Sharon Aguilar Zúñiga, 2021).*

Moreover, there are types of chiles that are used as a common base and others that are used for particular recipes or special occasions. On the one hand, the national variety of chile *guajillo* is the foundation of most hot dishes due to its flavour and mildness, and it is used either alone or combined with other varieties in dishes such as the *segueza*, black *mole*, *coloradito, pollo enchilado, enchiladas, the mole amarillo, the chintesle* (chile paste), *nopales* sauce, and more (Figure 5.17). On the other hand, chiles such as the *chilhuacle* and the *chilcostle* are only used for black mole, a celebratory plate. The chile *de onza*, endemic to the

region, is only used in moles and side salsas. More so, there are dynamic chiles, such as the endemic chile *de agua*, which, as stated above, can be consumed fresh or cooked (Figure 5.18), or the chile *de árbol*, which can be consumed fresh or dried in salsas due to its acute spice.

Figure 5.17 *Chile guajillo at the Central de Abastos, Oaxaca (Daniela Sclavo Castillo, 2021).*

Figure 5.18 *Roasting chile de agua in the ashes of the comal of Doña Felicitas Robles (Daniela Sclavo Castillo, 2021).*

In this sense, chiles in Tomaltepec are found in a wide array of shapes, colours, types, spice levels, and flavours. They come dry, fresh, green, red, orange, spicy, mild, small sized, large-sized; they can be found in broths and soups, stewed, in salsas, filled, roasted, or sliced with lime and onion. They are found growing in most house gardens and backyards, in family or community milpas, and bought in local stores, nearby communities, and from Oaxaca's biggest market, *La Central de Abastos*. Yet, this diversity of chiles and its presentations is not sustained by itself, nor by institutional or academic conservation efforts nor food security programmes; it is perpetuated by an entire system of knowledge, practices, and networks of local use. They are perpetuated because they are liked, because they are eaten. In the quotidian life of Santo Domingo Tomaltepec, a meal without chiles would be incomplete.

The *saber-hacer* of cultivating, cooking, and eating chiles, as described by Doña Inés Ramírez, a traditional cook or *cocinera* from Tomaltepec, is acquired and perpetuated mainly by the women of the community through oral transmission and embodied practices. It is in Tomaltepec's everyday life that generations upon generations are taught where the chiles are

found, how they are cleaned and deveined, how they are prepared, and which chilies are used for what. Deveining requires a specific technique and knowledge for removing the veins, head (peduncle), and seeds from the chiles. It is an arduous work, chile by chile, and it requires craft, patience, and meticulousness. Almost certainly, the hands will sting from manipulating the chiles. Depending on the cook's preference, some seeds will be left for extra spice, or removed in their totality to achieve a softer taste.

Through these practices, *cocineras* in Tomaltepec sustain chiles' cultivation, preparation, and networks of use, and therefore, their very existence. In this sense, chiles are fruits that, when deveined, release their spiciness and colour in the hands of grandmothers, and from them to other generations, creating threads of stories that materialise in the senses; in the itching of the hands, in the smell of the casseroles, in the colour they provide to dishes, and in the taste of what is cooked.

As in other communities throughout Mexico, Latin America and the world, kitchens and their users then become hubs of living biodiversity through a range of ingredients, their combination, their relation to situated territories, and the tastes they produce. As a type of gendered knowledge, it is in the hands and wisdom of many local and indigenous women that conservation practices are being bolstered alongside sovereign and local food networks, something remarkably unseen and backstaged by many scientists and so-called experts. This points to a more general matter: the achievement of food sovereignty and the conservation of crop diversity can hardly take place in isolation or without one another, as will be discussed. Accounting for the voices and ideas of value possessed by the ones that care, handle, and use diversity is relevant for understanding why, as scientists and governments, we have failed to conserve in better and more just ways.

Through conversations and joint cooking centred on chiles, held with older and younger women of Santo Domingo Tomaltepec, one thing became evident: concerns around chile loss and their imaginary futures did not relate to terms such as genetic resources, conservation science, food security/sovereignty, or biocultural heritage. Rather, chile's meaning seemed embedded in day-to-day life and enacted in actions such as cooking, eating, and cultivating it. Common expressions towards chile were that "*para nosotros es primordial tener una salsa o unos chilitos, si no hay, esta simple, no está sabrosa la comida*"… *"para mi*

comer sin chile no sería comer" (for us it is vital to have a salsa or some chiles, if they are not there, food is simple, not good… for me, eating without chile would be like not eating at all) (Carmen Santiago), or "*si no hay picante en mi comida no estoy tranquila, no tiene sabor… siempre siempre tenemos chile"* (if there is no spice in my food I am not at peace, it has no flavour… we always always have chile") (Lizbeth Santiago). In this sense, the importance of chiles is related to the senses, conceptualisations of wellbeing, the pleasure of eating, nutrition, belonging, memory, family, community, and territory, as will be detailed next.

Doña Inés Ramírez, active collaborator in Cocina Colaboratorio, invited us (colleagues Sharon Aguilar Zúñiga, Lucía Pérez-Volkow, Nicolás Roldán Rueda and myself) one afternoon in July 2021 to share how she prepares black mole. Now 78, Doña Inés Ramírez had learned traditional cuisine since the age of 12, and still prepares and sources everything herself: from transporting herself to the *Central de Abastos* and carrying all the ingredients, to harvesting or buying the rest of them in town, to peeling the cacao and toasting it, cleaning, and deveining the chiles, toasting the nuts, and cooking the broth. Mole's preparation takes about three days and is often prepared in groups due to the labour it entails. Yet, with her strong hands and tenacious personality, Doña Inés Ramírez often cooks complex traditional dishes entirely by herself, although more and more with the help of her daughter Marcela Cortés and her granddaughter Elisa Pérez.

At our arrival she received us with sweet bread and *atole* (as per usual in the community's rhythm), and then set out the instructions: today we will clean and devein chiles *guajillo*, *ancho*, and *chilhuacle* whilst we converse around the table. The houses in Tomaltepec propitiate encounters in or around the kitchen as they are generally outside the bedrooms, mostly in the open air, and next to the house garden or a middle patio. After finishing our *atole* we put our hands to action, without a clue of how arduous cleaning three packages of chiles would be (with this being just a fraction of the totality of cooking mole). Amongst inexperienced and expert hands working together, conversation sparked (Figure 5.19). Doña Inés Ramírez talked about the centrality of chiles for moles and all plates in the region, and how each woman in town had a different "hand" or method in choosing the quantities of each type.

Figure 5.19 *Chile guajillo being cleaned and deveined for mole preparation at Doña Inés Ramírez's house (Daniela Sclavo Castillo, 2021).*

Doña Inés Ramírez related chiles to her love for cooking, a knowledge she carries with pride and ownership: *"todos los chiles me gustan, frescos y secos, aunque más los frescos porque hago rajas con queso o rajas con huevo. Los secos siempre los limpio primero, los desveno, los tuesto, y luego con el ajonjolí y nuez con mi árbol de aquí"* (I like all chiles, fresh and dry, although fresh ones more so because I make strips with cheese or with egg. The dry ones, I always clean them first, devein them, and then roast them with sesame and walnuts that comes from my tree here in my garden [for mole]). Speaking about her famous mole, she points that the mole sold in the markets of Oaxaca city *"es diferente, no es como el que nosotros hacemos porque tiene conservadores, otros sabores y no es natural"… "no se limpian los chiles, no devenan los chiles, va con cola y como caiga, entonces en el mercado el mole que venden industrializado no es bueno"* (It is different, it is not like the one we make because it has preservatives, other flavours and it is not natural"… "the chiles are not cleaned, the chiles

are not deveined, they come with the tips, the mole that they sell is industrialised and not good"). This speaks about the meticulous care and detailed management of Ines's ingredients in her cuisine, linked to a space that she knows is her own dominion.

Beyond a source of income, Doña Inés Ramírez speaks about cooking as a way of life: *"a mí me gusta cocinar y hacer de todo… a la familia les echo la mano no les digo que me paguen y de su voluntad lo que me quieran dar, pero me gusta mucho, desde chiquita"* (I like to cook everything and enjoy cooking with everything…I sometimes help the wider family with cooking for them, and do not ask for payment, whatever they want to give me it's fine. I cook with pleasure since I was a little girl"). Marcela Cortés, her middle-aged daughter, says she acquired love for cooking recently, as she realised that much of her mother's culinary knowledge could be lost when she passes away: "*ya le estoy agarrando el amor a cocinar, yo hago todo lo que hace mi mamá, tal vez no a la primera pero si me sé todo. Aunque de chica no me gustaba luego le agarré el cariño"…"de nada te sirve comprar comida y no sabes lo que te van a dar, mi mamá siempre me ha dicho que es importante saber lo que te comes y prepararlo"* (I'm acquiring the love of cooking, I do everything my mom does, maybe not at the first try but I do know everything. Although I didn't like it as a girl, I later grew fond of it… It's no use buying food and you don't know what you're going to get, my mom has always told me that it's important to know what you're eating and to prepare it yourself).

More so, Doña Inés Ramírez also talks about how cooking takes her back to her first teacher, her Aunt Raquel: "*Yo creci con ella como si fuera mi mamá y mis primos como mis hermanos. Cocinar me remonta a ella también" (*I grew up with her as if she were my mother and my cousins as my brothers. Cooking takes me back to her too). In a way, the time, effort, and precision that Doña Inés Ramírez puts into her cuisine, in thoroughly choosing, cleaning, and deveining her chiles, relates to memory and care. This *saber-hacer*, transmitted now to Marcela Cortés and then to Elisa Pérez, threads embodied practices that keep chiles and other crops alive. Yet, this is exactly why Ines and other older women worry about the current fragility of the town's lifestyle, and the quality and diversity of their ingredients. As Doña Inés Ramírez expreses *"los conocimientos de la cocina se pueden perder, porque por ejemplo, ahorita todavía hay cosas que se hacen como antes pero la generación de ahora ya no ocupa tanto las comidas de casa, los materiales e ingredientes de acá, y pues lo hacen con otro*

sazón" (Culinary knowledge can be lost, because for example, right now there are still things that are cooked as before but today's generation no longer uses local foodstuffs, materials and ingredients from here, and so the food has another taste). The narratives of loss, omnipresent in the community, have emerged as a response to significant changes in diet and ingredients due to growing urbanization.

In this regard, Doña Inés Ramírez mentions how products in general were more natural when she was young, and how she has noticed that industrial agriculture, chemicals, and food preservatives had an impact on the seasoning and flavour of their diets. She gives the example of tomatoes as "*el jitomate era redondo y tenía rayitas y era más rico, y ahora ya no, el tomate de ahora está más sobrio. Antes de los pueblos venia la gente con sus canastitas a vender el tomate, era bien rico, pero ahora ya no" (*The tomato was round and had stripes and was more tasteful, and now it's not anymore, the tomato today is more sober. Before, people came to the towns with their little baskets to sell tomatoes, it was very delicious, but they don't anymore). More so, referring to ingredients brought from the *Central de Abastos*, Doña Inés Ramírez comments that "*antes había más producto regional, era más natural pues, ahorita ya no porque todo es puro fertilizante" (*Before there were more regional products, it was more natural, not now because everything is grown with fertilizer).

The fragility of the permanence of embodied practices and culinary knowledge are a matter of worry to many older and middle-aged women in the town, not only Doña Inés Ramírez and Marcela Cortés. Carmen Santiago, a 47 year-old traditional *cocinera* of Santo Domingo, who learned her culinary skills from her mother-in-law and who cultivates *piquín* and local *palito* chiles, citrus trees, papaya, banana trees, and vegetables like coriander, landrace tomatoes, and parsley in her house garden, thinks that the younger generation is not acquiring the necessary knowledge to continue the flavours of the town. She holds that a lot of youth in the community do not like the local tastes and dishes anymore. Yet, she conveys her love for cooking as "*a mí me encanta y me gusta verlos felices [su familia] y les gusta lo que les preparo y pues así con más ganas", "a mí me gusta cocinar de todo…aunque a veces estoy apurada o atareada me gusta mucho"* (I love it and I like to see them [her family] happy when they like what I prepare for them, and so I do it with more enthusiasm. I like cooking everything…although sometimes I am hurried or busy, I like it a lot).

This speaks of the many practices, knowledge, and traditions that are still alive and ongoing in Santo Domingo Tomaltepec. Carmen Santiago reflects that these *saberes* are important since *"lo principal es para nosotros mismos: consentirnos, una buena comida, es para uno mismo y el saberlo preparar y hacerlo con gusto para los suyos" … "además, es un buen trabajo, y para no perder la tradición, es muy bonito continuarla. Ojalá que haya muchachas que lo quieran aprender y así se va siguiendo*" (The main thing is for ourselves: to pamper ourselves, a good meal is for yourself and knowing how to prepare it and do it with pleasure for your loved ones …besides, it is a good job, and in order not to lose the tradition, it is very nice to continue it. I hope there are girls who want to learn it and continue like this). These insights reflect both the complexity of culinary knowledge and the ways it is valued by the ones that practice daily, reminiscent of Christie's conceptualisation of the kitchenspace as a gendered place where women are able to have autonomy, creativity, legacies, and self-determination within a patriarchal society (2006).

In this sense, the relevance that ingredients and their uses hold for many people in Santo Domingo Tomaltepec, as chiles and their flavours, converges in networks of emotion, systems of care, longing, belonging, and sustenance. Conserving here is not a passive or an abstract concept or seeds guarded in a box; it is an active endeavour. Yet, the worries of loss by inhabitants of Santo Domingo Tomaltepec do materialise in the actual disappearance of crop varieties and culinary practices, largely caused by growing urbanisation, the industrialisation of agriculture, and the homogenisation of foodstuffs. Doña Ernestina Santiago and her daughters Lizbeth Pérez and Magaly Pérez, who invited us to cook with them the local recipe of *yerbatole*, an *atole* made with *epazote*[13] and chile serrano (Figure 5.20), shared with us how chile varieties have changed in Tomaltepec in the last decades. Doña Ernestina Santiago, who is 80 years old, has lived in Tomaltepec all her life and like Doña Inés Ramírez, is one of the culinary authorities of the town. Greatly affected by the COVID-19 pandemic, which took the life of her two siblings, Ernestina Santiago's link to food is cemented in nostalgia and remembrance.

[13] Herb from Central and South America with a very distinctive aroma and taste.

Figure 5.20 *Doña Ernestina Santiago teaching Nicolás Roldán Rueda how to stir de yerbatole (Daniela Sclavo Castillo, 2021).*

Whilst drinking the *yerbatole*, Lizbeth Pérez, Doña Ernestina Santiago´s daughter, recounted how her aunt had an incredibly special hand for cooking, saying "*mi tía era muy especial para la cocina, todo era al pie de la letra como ella decía, y ella me enseñó a hacer el coloradito de pollo, el amarillo. Y a ella le gustaba que todo fuera criollo, ella no compraba en la Central de Abastos, iba con gente local, era muy especial con los ingredientes. El pan molido de Bimbo jamás*" (My aunt was meticulous for cooking, everything had to be exactly as she said, and she taught me how to make the chicken *coloradito*, the yellow one. And she liked everything to be heirloom or landrace, she didn't buy at the *Central de Abastos*, she went with

local people, she was very special with the ingredients. Bimbo's[14] processed bread was never a choice. With tears in her eyes, Doña Ernestina Santiago recalled learning side by side with her older sister, "*pásame la pimienta, y ya le pasaba yo el botecito… el mole le salía bien rico, ella tostaba el chile, las especies, todo*" (Pass me the pepper, and I handed it to her... Her mole was delicious, she toasted the chile, the spices, everything). In between the stories, Doña Ernestina Santiago mentioned how several of the chiles that she and her sister used when they were young were now either no longer available, hugely expensive, or found in lesser quantities. The chile *de onza,* for example, was found everywhere a few decades ago, and now most young people did not know how to cook it. Moreover, this endemic chile had become more expensive because of lesser demand and thus declines in production. Some people had *onza* plants in their gardens and milpas, but it was not a common sight anymore. The same was happening with the chile *palo* or *palito*, a variety similar to the chile *de árbol* but thinner and longer, as Doña Ernestina Santiago detailed. She then shared that her husband still planted this chile in their plot (Figure 5.21).

[14] Bimbo is the largest baking company in Mexico, and generally "pan Bimbo" is used to refer to industrialised or processed bread.

Figure 5.21 *Dry chiles of Doña Ernestina Santiago, including chile de árbol, palito, ancho, guajillo, puya, chilhuacle, morita, and pasilla (Daniela Sclavo Castillo, 2021).*

As part of the project's foundations, Emilio Hernández and I designed a participatory research encounter as a sign of gratitude for the women in the community, who had given their time and had received us in their homes to share their insights with us. The event, named "Chiles, Memory, and Clay: Conserving Flavour and Heritage", was an encounter that introduced clay crafting as an analogy for cooking – both of which are often collective endeavours and that require *saber-hacer* to achieve unique results. This activity was directed at creating chile pots or seed containers whilst enabling a guided discussion about chiles in a collective bonding space. The event took place in two days, 19th and 21st of December 2021, and involved the participation of Cocina staff members Emilio Hernández, Reyna Dominguez Yescas, Paola Miguel García, the author, potter Brenda Morales, community members Inés Ramírez Martínez, her daughter Marcela Cortés Ramírez, and granddaughters Elisa Pérez Cortés and Cynthia Pérez Cortés, Doña Ernestina Santiago Bautista and her daughters Magaly Pérez

Santiago and Lizbeth Pérez Santiago, Josefina Hernández López, her husband Juan Carlos Reyes Ramírez, Taydé Martínez Antonio, Carmela Canseco, her daughters Virginia García Canseco and Chepina García Canseco, and Community Chroniclers Manuel Juárez, Valentina Soto, Alejandro Soto, and Sinai Santiago.

Whilst learning how to mould the clay with the guide of Brenda Morales, we set to discuss the parallelisms between cooking and pottery. The parallel between the fragility of the clay and that of memory and practices was a powerful avenue explored by the group, as was the similarity of sharing a table and hands for a common objective (Figures 5.22-5.23). As we guided the discussion to the specificity of chiles, and the place they occupy in the daily life of Santo Domingo Tomaltepec, reflections sparked concerning how handling and preparing chiles (and traditional recipes more generally) required a special craft, patience, and embodied knowledge; just like the craft of clay making.

Very importantly, this experience also opened a door for a safe space. In the safety of the group, the women from the community, Community Chroniclers, and project members expressed their concerns, desires, pain, hopes, and care for the town's cultural richness and their territory's diversity. As the hands slowly shaped the clay into bowls or vases, the shapes presented themselves as metaphorical "containers of diversity", ones that need collective knowledge and effort to be created, that need to be cared for, and when broken, re-assembled, probably in a different shape.

This discussion and activity threaded to the meanings of the chile crop, which in words of participants is one of the most representative elements of flavour in the local food, but that also connected to sentiments of caring, of belonging, and of affection. The process, mediated by participative research and socially engaged art, brought a different view from individual oral histories; a joint take on chiles, one with a sense of community, an essential factor of life in Santo Domingo Tomaltepec. The collective sharing was invaluable to visualising how crops and ingredients have a common significance (Figure 5.24).

In addition, the women, both old and young, shared their worries about the loss of the culinary knowledge and the urgent necessity of implementing strategies to transfer those practices to younger people to keep them alive. Rather than a fear of losing "resources", their concerns were based on the fear of losing the community and family local ways of life: of

becoming an individualistic and unhealthy society, as they put it. Particularly older women expressed that, for them, the local culinary knowledge was a way of caring, of nurturing, of keeping the family together, of sharing, of having a space that is theirs, of loving. Also, they visualised their knowledge and practices as a way of perpetuating networks of production, exchange, trade of crops, and cultural practices, identities, seeds, and traditions. In a way, whilst the clay was being shaped by their hands, and a dialogue between past and future was held in the present, a sense of interest towards chile seemed to be fuelled within the group, who portrayed chile as a symbol of the "soul" of local foods, and as the major flavour giver in their diets. Potential pathways to enact the conservation of chiles and culinary knowledge practices were discussed, while also acknowledging the fact that some change would remain inevitable.

Figure 5.22 *Left, Doña Inés Ramírez painting ger clay plate (Daniela Sclavo Castillo, 2021).*

Figure 5.23 *Right, resulting clay pots and figures from the Chiles, Memory, and Clay workshop (Daniela Sclavo Castillo, 2021).*

Figure 5.24 *Chiles, Memory, and Clay workshop, from left to right Emilio Hernández Martínez, Josefina Hernández López, Daniela Sclavo Castillo, Reyna Domínguez Yescas, Doña Inés Ramírez Martínez, Elisa Pérez Cortés, Sinai Santiago, Valentina Soto, Nicolás Santiago, Marcela Cortés Ramírez, Cynthia Pérez Cortés, Brenda Morales.*

At this point, it was clear that chiles, through their flavour and the memories, emotions, and sensations they provoked, were central to the life of Tomaltepec's inhabitants, especially to the women that handled them. More so, cooking emerged as a way of life, as sustenance, as generational heritage, as a place of encounter and community, and as the base for nurturing one family's health and care. The value of chiles was immersed in their *saber-hacer*, and their loss accounted as a loss for their memory and belonging, not only for the chiles as individual varieties or ingredients. This is valuable insofar the methodology can speak to other ingredients, crops, places, and geographies through linking community building with the importance of biocultural heritage. In the act of cooking chiles, kitchens and embodied

practices revealed themselves not only as ways of caring, but as vital conservation hubs themselves.

Chile *Tabiche*: A Story of Loss, Memory, and Re-encounter

It was during another encounter with Doña Ernestina Santiago and her daughters Lizbeth Pérez and Magaly Pérez, where we conversed around sweet bread and *atole* (as per usual), that Doña Ernestina Santiago suddenly remembered a chile that her mother used to cook but that had completely disappeared. *Guiintabich*, she said, explaining that *guiin* means chile in Zapotec, the language they used back then. Silence filled the room as we reflected on the fact that crops and ingredients do not disappear on their own, but amongst entire networks of use, trade, practices, and even languages. From what she said, later confirmed by Doña Inés Ramírez and Doña Carmela Canseco, all older traditional *cocineras*, the chile *tabiche* had completely disappeared only a generation ago, approximately some 30 or 40 years back. As established in the summer of 2021 by Doña Ernestina Santiago:

> *"Me acuerdo de un chile que en fresco era como el chile agua, como el jalapeño, pero ese ya no está, es un chile que le decía mi abuelita Cecilia en idioma, guiintabich - guiin en zapoteco es chile - pero ya no veo ese chile, mi mamá lo compraba en la tienda y también a una señora que vendía pescado y queso de por acá. La señora y el señor vendían mucho ese chile, pero ya no se ve, ya no lo veo. Quién sabe por qué desapareció, porque mi mamá mucho lo acostumbró, en los frijoles. Cuando la gente lo deja de usar, lo deja de comprar y ya no lo quieren sembrar … se asaba como el chile de agua y lo hacía mi mamá en rajitas y lo ponía al frijol. Mi mamá le ponía unos gajitos de ajo y se lo revolvía … bien rico comíamos antes … ¡Qué íbamos a comer carne a diario! Antes solo comíamos los domingos, los domingos nada más se comía carne y en las fiestas… de resto eran frijoles, salsa y tortillas."*

(I remember a chile that when fresh was like chile *agua*, like jalapeño, but that one is no longer there, it is a chile that my grandmother Cecilia called in her language, *guiintabich – guiin,* which in Zapotec is chile - but I no longer see that chile, my mother bought it at the store and also from a woman who sold fish and cheese around here. The lady and the gentleman sold that chile a lot, but you can't see it anymore, I don't see it anymore. Who knows why it disappeared because my mother used it a lot in the beans. When people stop using it, they stop buying it and they no longer want to plant it... it was roasted like chile de *agua* and my mother made it in little strips and put it on the beans. My mother added a few pieces of garlic, and then she stirred it... we ate very deliciously before...How on earth were we going to eat meat every day! Before, we only ate meat on Sundays and at celebrations... the rest was beans, salsa, and tortillas).

Doña Ernestina Santiago's memory brought back the recollection of a seemingly forgotten variety, and with it, an array of stories and meanings, and of imaginary and past flavours and ways of knowing. Other women in town also shared similar memories regarding this chile, yet young or middle-aged women did not know about its existence, only older traditional *cocineras.* Inés, for one, had a very precise recollection of this chile, where it was found, and its culinary uses.

We visited and helped to toast and peel cacao seeds for chocolate sugar pieces, a product Inés sells in town, and which is used in Oaxaca for hot chocolate. Whilst peeling the cacao seeds, Inés shared a very detailed reminiscence of chile *tabiche* in her youth. She mentioned that her grandmother used to plant *tabiche* seeds in their house garden and that one could find it pretty much everywhere in town both fresh and dry. She also remembered that her favourite preparation of *tabiche* was a salsa made with garlic, *"me lo enseñaron mis abuelas, quienes hacían salsa para comer con tortilla o tlayuda, pues lo usábamos mucho, lo untábamos con la tortilla con chapulín en ese entonces" (*My grandmothers taught it to me, who made a sauce to eat with tortilla or *tlayuda*, well we used it a lot, we spread it in the tortilla with grasshoppers at that time). Today, other chiles had replaced the *tabiche* in the salsas. Similarly to Doña Ernestina, who compared the loss of language with the loss of *tabiche*,

Inés remarked the transformation of cooking materials: *"las cosas de barro, antes solo se ocupaba eso y le cambia el sabor…por ejemplo el frijol en olla de barro sabe diferente y además en la lumbre, no en olla de aluminio ni en la estufa"* (before, we only used clay materials and it affected the flavour...for example, beans in a clay pot cooked in the fire taste different than in aluminium pots cooked in the stove). Therefore, the loss of an ingredient for these women is linked not only to an individual element but to a variety of elements that accompany the whole culinary system, such as language, quality or traditional materials, and flavours that accompany memories.

Regarding the *tabiche*, Inés added that these chiles used to be roasted fresh with lime, but that one could not find it fresh anymore in Santo Domingo Tomaltepec. Interestingly, she said that one could still find it fresh in December (in harvest season) in Yalalag, North Sierra of Oaxaca, Ocotlán in the Central Valleys of Oaxaca, and in Ejutla de Crespo in the Southern Sierra. Moreover, she remarked: "*El chile tabiche seco se encuentra en la Central de Abastos. Yo los llevo*" (Dry chile *tabiche* can be found in the *Central de Abastos*. I'll take you there). And so, we visited the *Central de Abastos* the very next day, on the 23rd of July, 2022.

In the *Central de Abastos*, whilst looking for the chile *tabiche* we were able to speak with several chile vendors that sold dry chiles coming from Oaxaca, other Mexican states like Zacatecas, and imported ones from countries like Peru, China, and Japan. In contrast with dry chile vendors, fresh chile vendors did not have as many regional varieties, since fresh chiles are seasonal and dry ones are more easily stored.

In the first four stands operated by "Don Tino", "Juárez", "Rico Mole", and "Chiles Memo", we received the same information: local landraces, not only from Central Valleys but from Oaxaca more widely, are decreasing in sale and production (Figure 5.25). They said their main sales were from industrially produced chiles like *guajillo* or *ancho* from Zacatecas, or even imported chiles, as prices were lower and thus, more affordable than local ones. This information was striking considering Oaxaca is the most chile diverse state in Mexico and a place where culinary traditions are still very rich. Curiously, these four vendors did have small sacks of *tabiche* to sell, but they told us sales were very low, and that only older women, mainly traditional *cocineras*, bought it. The same happened with chiles like the *onza* or *costeño;* "they will eventually stop being sold", one of them said. According to their four

testimonies, it was approximately 15 years ago that imported chiles from Zacatecas and abroad had cornered the market, displacing, and making Oaxacan regional chiles more expensive.

Figure 5.25 *Rico Mole dry chile stand in the Central de Abastos, Oaxaca (Daniela Sclavo Castillo, 2022).*

For more information about the chile *tabiche* and other endemic Oaxacan varieties, they directed us to Gate 7, where we could find the only specialised local chiles stand in the *Central de Abastos*: "*El Oaxaqueño*" (Figure 5.26). Wenceslao, the owner, was well known in the Central for being the only dry chile vendor to maintain a business model based on large quantities of endemic chiles. Carlos, the owner's son and a chile vendor himself, received us

warmly. He shared with us that his father prioritised local products, sourced from Oaxacan producers in several regions of the state, and that their main clientele were traditional *cocineras* and chefs from Oaxaca City. Some of the chiles they sold were the *tabiche*, the *pasilla mixe*, *costeño, onza, chilcostle, chilhuacle*, amongst others.

Figure 5.26 *El Oaxaqueño chile stand in the Central de Abastos, Oaxaca (Daniela Sclavo Castillo, 2022).*

Regarding the chile *tabiche* and its production, he said that they brought dry chiles from the Southern Sierra of Oaxaca, specifically from Miahuatlán and Ejutla de Crespo, where production is the highest (Figure 5.27). This is confirmed by the limited existing literature on chile *tabiche*, mainly carried out by INIFAP scholar Porfirio López López, who established Miahuatlán and Ejutla as a centre of production of *tabiche* (Aguilar-Rincón et al., 2010, p. 68; López López y Castro García, 2006, p. 162).

In the *Central de Abastos*, Carlos said that chile *tabiche* could be found fresh only once a year, and only in December with a woman that came from the Istmo de Tehuantepec, where "the Tehuanas" (Zapotec women from the Istmo) sell their products. In line with what women in Tomaltepec had previously shared with us, he mentioned that when networks of use deteriorate, ingredients and varieties, alongside practices gradually disappear, "*los chiles endémicos son como las lenguas, a veces por pena o por dedicarse a otras cosas se van perdiendo*" (endemic chiles are like languages, sometimes because of shame or for doing other things they are lost). In addition, he said that the regional chiles are needed for a good quality mole, but sometimes they are too expensive for local family economies. Then, people are forced to buy industrialised or imported chiles. He also stated that many young people do not have the knowledge of how to use these chiles and therefore do not buy them. In this regard he highlighted the importance of networks of use and commerce, which if broken, add to the mobility and production of local products. To finish, he mentioned that besides the *tabiche*, chiles such as the *cascabel*, the *chilhuacle,* the *chilcostle* are also becoming scarce.

Figure 5.27 *Dry chile sack of tabiche at El Oaxaqueño chile stand in the Central de Abastos, Oaxaca (Daniela Sclavo Castillo, 2022).*

This vendor's reflection underlined what scholars such as Nazarea and Abarca have pointed out in their work: practices and memory have a crucial role in the conservation of biocultural diversity, a fact that remains largely side-lined in food, conservation, and heritage policies. In this sense, recovering and exploring the *tabiche* story in Santo Domingo Tomaltepec is not directed at telling a story about its *extinction*, but rather to signal how local processes and relationships to crops are more complex than a dichotomy of existing or extinct.

The transformation of local ingredients and flavours, which involves the loss of some and the perpetuation of others, is probably an inevitable aspect of food systems. Yet, the underlying processes of use, trade, local value, flavour, food production and consumption, as well as cultural and affective links between people and ingredients, plants and territories can significantly shape a food system and its components, as well as the livelihood and health of

populations – all within a globalised and liberal economic system. There is more to uncover behind individual types of genetic resources; crops are not individual entities. They need land, soil, harvesting, transformation, preparation, knowledge, and hands to manage, produce, cook, or sell them. Therefore, in thinking about loss and conservation, it is worth analysing how memory, practices, conceptions of value, networks of use, and economic limitations can shape the movement, perpetuation, or local abandonment of given varieties.

Old and New Encounters: Chile Tabiche in the hands and palates of Santo Domingo Tomaltepec

With the information sourced from the literature and from what was shared to us by Doña Ernestina Santiago, Doña Inés Ramírez, Lizbeth and Magaly Pérez, Marcela Cortés, Doña Carmela Canseco, and Carlos, a trip was organised to Ejutla de Crespo in the Southern Sierra of Oaxaca. There, Cocina Colaboratorio Transdisciplinary Coordinator, and environmental scientist Lucía Pérez-Volkow was able to speak with locals and their relation to this endemic chile. In the market, chile *tabiche* was found in all possible presentations: fresh in red and green, dried *tabiches* of various sizes, and *tabiche* seeds as well. Vendors said that besides Ejutla, *tabiche* was widely produced and consumed in Miahuatlán and Ocotlán. More so, chile vendors in Ejutla market mentioned that it was their "*chile del diario*" (everyday chile), generally prepared in salsas with red tomato or *miltomate* (green tomato) (Figure 5.28).

Figure 5.28 *Fresh and dry chile tabiche in Ejutla de Crespo's market (Lucía Pérez-Volkow, 2022).*

The fact that this same chile had disappeared and was almost forgotten in Santo Domingo Tomaltepec, only an hour and a half drive away, was mesmerising. Chile *tabiche* in Ejutla de Crespo seemed as common as chile *de agua* in Tomaltepec: as if it was in no risk of ever vanishing from this territory. The women in the market were well aware that chile *tabiche* was declining in Oaxaca City, and they were aware that it was rarely found in the *Central de Abastos*. When Lucía mentioned how we were part of a food sovereignty project from the Central Valleys, near Oaxaca City, they responded "*pues acá existe [el chile tabiche], acá lo cultivamos, con esta semillita lo pueden volver a sembrar*" (it exists here [the chile *tabiche*], we cultivate it here, with this seed you can plant it again).

Here, it is worth adding to the complexity of the networks of use mentioned earlier in the chapter. More than genetic resources found in seeds or varieties that need to be protected and safeguarded, biocultural diversity arises from the moment a seed is placed in the soil, to

its growth, its transformation or preparation in either a dish or its commercialisation in local, regional, or national markets, to the consumers and then again to the producers who keep the seeds alive and evolving. A variety can cease to exist in a place due to price changes or the abandonment of culinary or agricultural practices, and still be found in a nearby town. Loss, as memory, is not binary or absolute. Rather, it shapes both situated territories and ways of being. One might have a seed and not know how to cultivate, grow, and/or cook it. On the other hand, one might not have a seed and know how to cultivate it, grow, and cook it. One might also remember its taste and the people or circumstances around its *saber-hacer*. In this sense, strengthening these every day and seemingly superfluous networks of use can be a powerful tool for crop conservation efforts.

Memory revived chile *tabiche*'s enunciation in Santo Domingo Tomaltepec: its name and its history and several stories in between. Yet, memory alone would not physically bring *tabiche* back to the community. By speaking to the group of women we collaborate with in Tomaltepec, we co-formulated an art-mediated and participatory event to re-plant and cook the chile *tabiche* in Tomaltepec for the first time in decades. Indeed, we took the word and advice from the women at the Ejutla market and brought back *tabiche* seeds and chiles with us (Figures 5.29-5.30).

Figure 5.29 *Left, fresh chile tabiche from Ejutla de Crespo, Oaxaca (Daniela Sclavo Castillo, 2022).*

Figure 5.30 *Right, dry chile tabiche from Ejutla de Crespo, Oaxaca (Daniela Sclavo Castillo, 2022).*

The event occurred on the 2nd of July 2022 and encompassed a considerable attendance from the community, including many *cocineras*, families, Community Chronicles and Cocina Colaboratorio staff. It took place in the family plot of Josefina Hernández and Taydé Martínez, two local women who initiated an agroecological parcel on their own with the support of their family, especially Josefina Hernandez's husband, Juan Carlos Reyes. Both women were focused on changing their family eating habits, producing local vegetables and crops, and making the project a community-building space. Josefina Hernández, who has two little daughters, Luna and Luz Elena, had been determined in the last three years to teach them to source their own food and to connect to the soil, something she managed to do until her adulthood. As she expressed, "*todo es para ellas"* (it is all for them [her daughters]), "*vienen [a la parcela] y las veo felices, involucradas… nos va a tomar tiempo pero se que ellas van a aprender*" (they come [to the plot] and I see they are happy and involved… its will take us time but I know they will learn). As active collaborators of Cocina Colaboratorio, we all

figured Josefina Hernández and Taydé Martínez's plot was the perfect place to sprout the first *tabiche* seeds.

Cooking chiles took take place with an intergenerational lens: for those who knew *tabiche* and for those who were just about to taste it for the first time. Thus, the event was a space to bring back old flavours and to innovate new ones. This was thought of as a challenge to immutable "authenticity" of traditional recipes, as changes in food systems are inevitable. It is the substance of what we care about that we can restore and sustain through community building.

The encounter used a mobile stove, two big tables, seedbeds, kitchen utensils, and locally sourced vegetables and fruits to cook salsas. As the invitation was extended throughout the town, the public in attendance varied in age, gender, and profession. Once together, we planted the *tabiche* seeds and conversed about bringing a "lost" ingredient back. As older participants shared their stories of what they remembered, younger ones shared their imaginary future connection to a variety of chile that their ancestors cultivated, cooked, and enjoyed (Figure 5.31). After planting, agreements were made on the shared responsibilities in caring for the sprouts, growing, and harvesting the chiles, and perpetuating the seeds and fruits throughout the community. Subsequently, hands to salsa making!

As the salsa laboratory took place, chile *tabiche* materialised beyond long-gone memories or imaginary experiences. An array of existing recipes and new ones were formulated. Inés cooked the *tabiche* and garlic salsa her grandmother used to make (Figure 5.32) whilst her daughter Marcela Cortés created a *tabiche* salsa of her own with mango and avocado. Taydé Martínez cooked a more traditional salsa with *tabiche*, *guajillo*, and *ancho*, and Josefina Hernández innovated with ingredients like lime, avocado, and mint.

Figure 5.31 *Planting chile tabiche seeds (Daniela Sclavo Castillo, 2022).*

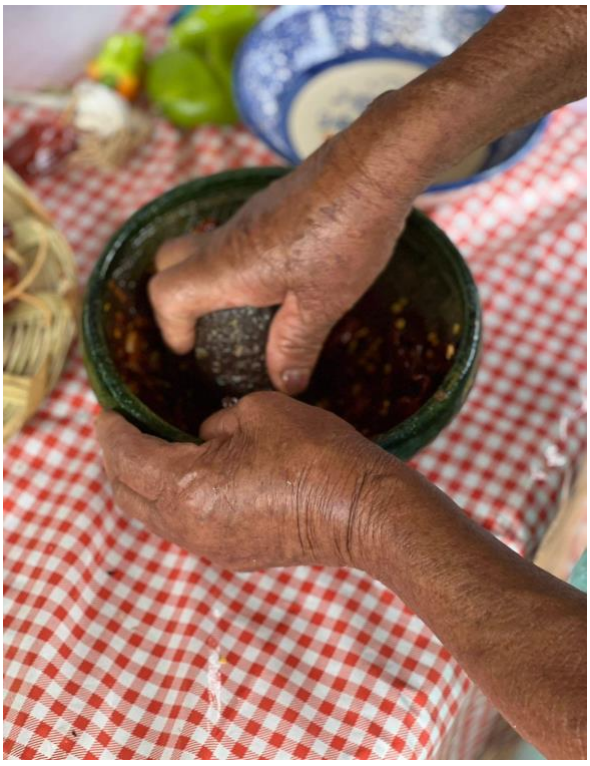

Figure 5.32 *Doña Inés Ramírez preparing tabiche and garlic salsa (Daniela Sclavo Castillo, 2022).*

Through the chile *tabiche* research and through all the shared conversations, it was clear that memory is a very powerful tool to recover crop varieties, or other elements, that are lost to given territories. Yet all these memories and stories need to be enacted and activated by community building and by directed action towards strengthening networks of use. In this sense, the participatory research that took place between Cocina Colaboratorio and inhabitants of Santo Domingo bridged different types of knowledge from academia, the sciences, the arts, and the local *saberes* – a gap that has not been yet crossed at wider institutional levels.

Last Reflections: Towards the Celebration of What There Is

From this chapter's story, several reflections emerge in light of previous ones. Firstly, and very importantly, this chapter presents a story of the practices, knowledge, networks, and biocultural diversity that are still alive; it accentuates what *there is*. Histories of conservation often focus on what is lost, or about to be lost. Indeed, loss is a real problem for biocultural diversity, and, as demonstrated in this chapter, it remained a constant in the conversations and encounters of this work. Yet, a lot of what came about in these interactions was about what is alive. For that, I would like to conclude noting that recognising and celebrating existing practices and knowledge is important to strengthen and caring for what is already in motion. It is important to signal the dangers in loss, but also to celebrate what is thriving and ongoing. In this sense, the story of the women *cocineras* of Santo Domingo shows a situation where local conservation practices challenge, and even surpass, institutional conservation efforts through actions such as cooking salsas, maintaining collective work, nourishing house gardens, and organising community *fiestas*.

This story of interdisciplinary community work questions the often catastrophic and absolutist vision of diversity loss, which has historically prioritised the collection of crops to keep them "safe" in banks or inside institutional halls in the guard of "experts". As part of the post-Green Revolutionary framing of conservation and agriculture, INIFAP researchers in the

1980s stated that local varieties of chile would be inevitably lost to industrial and standardised chiles. They argued that we needed to collect and save them all in seed banks so we could have that genetic material available to breed more chiles when necessary. Today, the resilience of existing local networks of use and landraces – as demonstrated with chile in Tomaltepec in an example transferable to many rural and even urban communities around the world – highlights the value of ingredients and foodstuffs beyond the capitalist logic of yield or economic gain. It is something that is very much alive, yet at risk. People in the Central Valleys of Oaxaca keep eating chile de *agua*, as heterogeneous as it may be, because it is liked, because it means much more than a product, because it is *sabroso* and has been so for generations.

In this sense, as shown in previous chapters, scientific and policy structures have side-lined the reality and the preferences of the very people who plant, consume, produce, and eat the diversity that states and big institutions name as precious for the future. More so, they have obviated gendered spaces and knowledge such as kitchens and the women who inhabit these, failing to recognise them as valid and crucial conservation hubs.

Even when ethnobotanists and agroecologists in the case of Mexico pushed against agroindustry as the main strategy for agriculture from the 1970s onward, trying to promote a political rural agenda that integrated traditional agricultural systems as essential for both rural development and the conservation of biodiversity, spaces like kitchens and women's knowledge remained neglected. More so, at a policy level, these calls were superficially attended to, if heard at all. This is evident from the food security strategy that the Mexican state have defined over the last three decades; one which prioritises industrial agriculture and that subsidises industrialised foodstuffs to marginalised populations, rather than promoting locally sovereign food systems.

Therefore, strengthening existing local networks of use is crucial for the conservation of biocultural heritages and the attainment of food sovereignty. As shown with the case of Cocina Colaboratorio, creative support can serve as a way of protecting and respecting ways of life that are valuable to the people that live them. These alternative approaches to food sovereignty allow for the envisagement of collective and interdisciplinary ways of caring for diversity without separating diversity itself from the ones who actively care for it.

As such, this final chapter attempted a "history in the making" that was realised through the collective. In this process, memory arose as a vital element for action. *Cocineras'* memories were important and had many flavours. They evidenced that in the process of remembering, one can go back to a specific taste, a moment, a person, a place, a practice. Moreover, they showed how a memory can plant a seed of intention, of doubt, or of curiosity that grows and blooms into action. Memory then shapes not only the past; it threads into present desires and, in this case, in the material re-appropriation of chile *tabiche.*

By exploring a situated case of local chiles, this chapter certainly did not attempt to argue that industrial chile production is something inherently "wrong". Large-scale production is needed to meet domestic and international demand. Rather, the chapter suggested that the diversity that scientific and political structures cherish is sustained by other ways of life. These also need protection and just acknowledgement. Moreover, it highlights that relegated actors such as women *cocineras* need to be listened to by conservation and agricultural scientists, politicians, and all academics alike.

Whilst the chile *tabiche* story in Santo Domingo Tomaltepec shows that not all is lost and that there are still ways of rebuilding threads of use and knowledge, the risk of erosion grows with a decrease of intergenerational knowledge transfer, particularly of embodied culinary practices and agricultural traditions. This realisation, that conserving means keeping things alive, implies acknowledging that it is not only the seeds or varieties that are lost: it is the dishes, the heirloom plants, the embodied practices, the exchanges – *what the hands know to do*. All these living implications make crop varieties linger: the languages, the celebrations, the plants in house gardens and milpas, the movement of the expert hands, the *tequio* or community work, the gatherings around a table – all this is also conserving, with or without scientific validation.

Therefore, participatory research and interdisciplinary collaboration, with projects such as Cocina Colaboratorio, are useful to the history of crop conservation, agriculture and to academia more generally. Firstly, by integrating voices, stories, and narratives that have been side-lined by hegemonic discourses, archives, institutions, and powerholders. Secondly, by doing so from a place of mutual collaboration and equality, and not from a mainstream interview-interviewee dynamic, where power structures are tangibly hierarchical and

exploitative. Likewise, projects such as Cocina Colaboratorio benefit from historical and social sciences insofar as they highlight the complex socio-political and economic dynamics that are inserted in the current globalised system.

In a world dominated by capital and Western thinking, particularly in the sciences, it is valuable to highlight the extensive knowledge behind everyday practices – and for it to be considered by decision-makers and so-called "experts". Women *cocineras* of Santo Domingo Tomaltepec perpetuate the existence of chiles in ways that institutions, scientists and other scholars like myself need to listen to and understand more deeply. Sometimes, an act as seemingly simple and mundane as cooking a salsa, deveining a chile, or sharing a meal can become acts of resistance, of resilience and change, of more hopeful and collaborative futures.

Conclusion

When chile *tabiche* was planted on Josefina and Taydé's plot in July 2022, many seedlings did not survive, and many more did not become *tabiche* plants. The attempt to grow *tabiche* in Santo Domingo Tomaltepec in July 2022 was not entirely successful. Bringing back *tabiche* seeds did not mean there was the knowledge or expertise to grow them. The reappropriation of this chile by the community did not come without difficulties, and it certainly posed many questions as to how and why this chile was being re-cultivated, re-grown, and re-eaten. Yet, as time passed, chile *tabiche* has slowly regained a place in Santo Domingo Tomaltepec. This has been evident in subsequent collective culinary events and in the kitchens of several *cocineras,* where *tabiche's* flavours have started to enrich the local plates and salsas once again. Whilst growing *tabiche* has been a challenging process with an uncertain future, access to dry *tabiche* has been possible through acquiring it at the *Central de Abastos* in Oaxaca City. In its own pace and shape, *tabiche's* place is being re-woven in the biocultural matrix of Santo Domingo Tomaltepec, albeit not in the same way it once was. This story of re-encounter and comeback of *tabiche*, showed that rethreading networks of use, of embodied knowledge, of exchange and belonging, is not a straightforward nor linear endeavour.

This dissertation sought to emphasise the complex nature of framing diversity, its impermanence, and its continuity – instead of offering a story about chile loss and erosion. It has argued that chile conservation happens not only in seed collections or databases in national reservoirs, but also in practices that are very much alive, such as in the culinary practices of Santo Domingo Tomaltepec. Therefore, this thesis has traced different angles of chile conservation to show it as a complex, malleable, and ongoing set of processes rather than as a defined endeavour. In doing so, it ultimately revealed the limitations on crop conservation historiography in approaching conservation as a process that extends beyond

institutional halls; in telling stories that are cooked, deveined, planted, eaten, and remembered.

In this sense, by exploring the chile histories of *agrónomos*, ethnobotanists and agroecologists, food security policies, and the community of Santo Domingo Tomaltepec, this work aimed not at telling separate stories, but at highlighting why conservation and food security efforts have been constructed in such a way that many voices and ways of knowing have not been heard. By intersecting these stories, this dissertation unveiled the historical roots of exclusionary practices in conservation and food policy, but it also went further by questioning how is it that we can envisage more integral ways of conserving biocultural diversity whilst also delivering just and sovereign food systems. Whilst the local practices cannot be institutionalised themselves, they can certainly be acknowledged, included, and supported as fundamental for the conservation of biocultural diversity in regional and national enterprises.

This vision, I believe, will involve expanding current institutional conceptualisations of crop's value. For one, by validating other ways of relating to crops, such as those enacted in local scenarios where crops are valued beyond them being "genetic resources" and cherished for their flavour, for their texture, for their affective components, for the memories they ignite. Moreover, a de-centralisation of caloric crops in institutional and academic research, and in food policy, is needed to valorise crops that might not be caloric, but that are culturally and nutritionally relevant, such as chile. This means that for conservation strategies and food policy to become more inclusive and effective – from the local to the regional, to the national – a paradigmatic shift will be required at the state level in terms of the priorities that have so far guided agricultural production, crop conservation, and food security, as discussed throughout the thesis.

As Mexico entered a new presidential administration in 2018, one which will be followed by the same ruling party starting on October 2024, rural programmes such as *Sembrando Vida* have delivered more economic support for small and subsistence producers. This programme's objectives were set to tackle rural poverty and environmental degradation by promoting local agroforestry production systems. According to Don Feliciano Martínez, an elderly farmer of Santo Domingo Tomaltepec, this has been the first welfare programme in a

long time in which he receives support to produce in his *milpa*. However, the programme's benefits have been questioned by academics and critics, who have manifested their concerns regarding the programme's intentions in actually promoting environmental regeneration and community building (Meza Hernández, 2022). Despite the improvements that *Sembrando Vida* delivered regarding a more equal distribution of rural investment, agroindustry still holds most production power and profit, and food security policy has not yet managed to meaningfully support local food production systems.

This challenging reality arises from a capitalist and patriarchal logic that perpetuates the difficulties of bridging situated food sovereignty and conservation efforts with institutional and government structures. In addition, these circumstances happen in a time when climate change and subsequent environmental crises have had serious consequences, mostly in marginalised populations. Examples of these are the droughts in Mexico of the last three years, where small producers without access to irrigation systems have been hugely affected (Huerta, 2024; López Suárez, 2024). In 2024, the water dams of Santo Domingo Tomaltepec were completely empty for the first time.

This dissertation and other accounts have made clear that institutional conservation through, for example, seed banks, and paternalistic welfare programmes are not enough for conserving biocultural diversity and producing just food systems, both of which go hand by hand. Hence, promoting collaborative projects and community building efforts becomes vital for the future of diversity and food, for sustaining life and for addressing further environmental hazards. Community-based food sovereignty projects such as Cocina Colaboratorio are a response to, and exist within the logic of, the current market-based economic system, as do many other existing collectives, peasant organisations, and activist groups. This is symptomatic of the colossal limitations of the current system to address inequality, access to appropriate means of production, and the growing hegemony of agroindustry in food systems. As such, these emerging collectives are a call for action, for creating tools of resistance in a system that seeks to standardise diets, foodstuffs, seeds, fields, and plates. Change relies on the advancement of these initiatives alongside an abrupt shift of support and collaboration from big institutions and governments towards the investment of local and sovereign food networks.

It is in today's context that remembering, eating, and cooking together – seemingly simple daily activities – become essential political acts of resistance. Through them, as shown with the chile stories of Santo Domingo Tomaltepec, it is possible to confront the uniformity of our food systems, one that increased since the latter half of the past century through the technification of agriculture and the introduction of highly processed foods. As transnational companies retain control of the food system and seeds, and as food gets more and more commodified and tasteless, new narratives need to be told as a source of hope, as a source of action. Pushing for the strengthening of local networks of knowledge, use, and exchange does not mean that industrial agriculture and institutional crop conservation in seed banks are inherently "bad" or "wrong". Rather, as shown in this thesis, that food policies and state conservation strategies have largely prioritised the latter, benefitting an enclosed elite and thus neglecting other practices and ways of life that matter for those who perpetuate them and for the protection of their biocultural heritage and territories.

Whilst there is still much to do in order to achieve better conservation and food systems, and whilst this account of chile evidenced the limitations of crop conservation and food policies from the last four decades (ones mostly based on calories and yield), this story also recognised the emerging dialogue between the state, scientists, and local populations. For one, the collaboration achieved in SINAREFI as state initiative that integrated *agrónomos* and ethnobotanists, albeit problematic, represented a big turn from the conversations and discourses that both groups had in the 1970s and 1980s with respect to one another, to food systems, to local knowledge, and to gender and culinary practices. In a similar line, this thesis showed how ideas on food security and sovereignty have evolved to integrate the importance of flavour, of belonging, and of food preferences, both in research and in food policy.

Signalling the ideological transformation within crop conservation efforts and food policy of the last decades, alongside the increasing inclusion of decolonial and feminist perspectives, shows that there is an ongoing transformation with regards to how biocultural conservation and food systems are being conceptualised and constructed. Despite the many challenges at door, change towards more inclusive crop conservation and food systems efforts is not a matter limited to the future. The change towards more inclusive food systems, both in research and in the shape of social mobilisation, has been, quite literally, bred and

cooked by a variety of actors for the last four decades. It is also happening now. This can be extended to global discussions and to other regions of the world where the intersections between institutional and local/embodied practices, and between food policies and food sovereignty movements, are similarly complex (see Agarwal 2014; Bopp 2020; Twagira 2021).

An account of chile, through this crop's taste and sensual qualities, helped to stress aspects that matter beyond calories and nutrition, such as what is in our plates, where it comes from, what flavours speak to us, what we cook in our kitchens, why we care for it, and why it matters in everyday life, in policy, and in institutions. This story reminds us that enjoying, tasting, remembering, and using our bodies can also be vital tools for enacting both social change and biocultural conservation. Finishing with a positive outlook, something that the women from Santo Domingo Tomaltepec frequently remarked is that the more we cook, the more we perpetuate what makes us *us*, the more we remember the ones we love, the more we connect with our territories and with the kind of world we want to build. This, more than contradicting discussions on diversity and genetic resources, reminds us that sometimes we do not need to build giant vaults in the corners of the earth to perpetuate or care for the diversity around us. There is still a lot that is being eaten, cooked, transmitted, exchanged, and cultivated, and that is also something important to narrate – and *do* –.

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Carmela Canseco

Carmen Santiago Martínez

Chepina García Canseco

Cynthia Pérez Cortés

Doña Ernestina Santiago

Doña Inés Ramírez

Elisa Pérez Cortés

Emilio Hernández Martínez

Felicitas Robles Martínez

Josefina Hernández López

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