















Cocina Laboratorio: cooking transdisciplinary transformations of local food systems

[Patricia Balvanera](#)¹ , [Mariana Martínez Balvanera](#)², [M. Azahara Mesa-Jurado](#)³ , [Lucía Pérez-Volkow](#)^{1,2} , [Adriana Cadena Roa](#)^{1,2,4}, [Reyna Dominguez-Yescas](#)^{1,2,4} , [Elizabeth Guerrero Molina](#)¹, [Emilio Hernández Martínez](#)^{1,2} , [Diego Hernández-Muciño](#)^{2,5} , [Gabriela Alejandra Morales Valdelamar](#)⁶, [Nicolás Roldán-Rueda](#)⁷ , [Rafael Lombera](#)⁸, [Paola Miguel García](#)⁹ , [I. Nuri Flores-Abreu](#)¹⁰ , [Felipe Arreola Villa](#)^{1,2}, [Lyliana Rentería](#)^{1,2} , [Claudia Heindorf](#)¹¹ , [Pedro Ortiz Antoranz](#)¹², [Luis Equihua Zamora](#)¹³ and [Lucía Oralia Almeida Leñero](#)¹⁴ 

ABSTRACT. Transdisciplinary knowledge co-production has been deemed critical to support the transformative changes needed to navigate toward more just and sustainable futures. Novel collaborations between local stakeholders, artists, designers, and scientists have the potential to further advance such transformations. In this paper, we describe the work of the transdisciplinary project Cocina Laboratorio. We describe how the project was born and established in three territories of Mexico. We explore how participatory artistic and design practices, centered around the kitchen, played out in creating and operationalizing arenas for exchange and experimentation. We depict the components of our theory of change, including the role of these arenas, individual and collective agency, and leverage points in the transformation of local food systems. We illustrate the challenges encountered and the opportunities to overcome them, namely finding common ground through diverse communication strategies, a collaboration protocol, monitoring, and iterative learning. We assess our outputs and products, the role of funding as an enabler and obstacle, and our strengths and weaknesses. Participatory artistic and design practices have a huge potential to nurture deeper and more meaningful transdisciplinary transformative research around the globe, and we aspire to make deep transformations in each of the three territories while contributing to global sustainability.

Key Words: *agency; food systems; innovation; leverage points; participatory artistic and design practices; transdiscipline; transformative change*

INTRODUCTION

Transdisciplinary collaborations have been deemed critical to navigate toward more just and sustainable futures (Ely et al. 2020). The transformative changes needed—i.e., the fundamental, system-wide reorganization of social-ecological systems across technological, economic, and social factors, including paradigms, goals, and values (IPBES 2019)—can only be achieved through the active exchange of different types of knowledge across disciplinary and stakeholder type boundaries (Clark and Harley 2020). Identifying commonly defined goals relies on the explicit recognition of the multiple ways of knowing, doing, and being specific to each context (Ayala-Orozco et al. 2018). Frequent, inclusive, relevant, and respectful interactions among members of these transdisciplinary collectives are needed to jointly frame and design the research agenda, conduct the research, apply, use, and disseminate the knowledge generated (Norström et al. 2020).

However, transdisciplinary collaborations face key operationalization challenges, including addressing power relations and fostering individual and collective agency. Power imbalances, associated with differential funding, knowledge and skills, background, and intersectionality shape how different types of stakeholders participate in transdisciplinary processes (Turnhout et al. 2020). Tools are needed to recognize these power relations and to

empower traditionally marginalized voices to inquire, debate, and question (Staffa et al. 2022). Addressing the root causes of such structural inequities entails activating the internal agency of individuals, boosting social learning and collective agency, and reframing the dominant narratives to trigger a cascade of individual and collective transformations toward system-wide changes (Benessaiah and Eakin 2021, Charli-Joseph et al. 2023).

Novel approaches to transdisciplinary transformative research that address the above challenges can emerge from collaborations between researchers, stakeholders, artists, and designers. Research innovation and creative thinking are nurtured by combining fast intuitive thinking promoted by the arts and slow reasoning processes guided by science (Scheffer et al. 2015). For example, awareness and participation in addressing climate change have been encouraged by artistic creations (Galafassi et al. 2018). Innovation and creativity are needed to break away from the status quo (Pereira et al. 2021). Tools are increasingly being developed to build upon success stories, create safe spaces, and boost imagination beyond business as usual (Hensler et al. 2021). Alternative futures have been triggered through artistic and design tools (Dulic et al. 2016). Design tools have been used in social transformation labs (Pereira et al. 2021). Yet, creative design practices have largely been underexplored in science, public policy,

¹Instituto de Investigaciones en Ecosistemas y Sustentabilidad, Universidad Nacional Autónoma de México (UNAM), Morelia, Mexico, ²Cocina Laboratorio, ³Departamento Ciencias de la Sustentabilidad, El Colegio de la Frontera Sur, Unidad Villahermosa, ⁴Secretaría de Ciencia, Humanidades, Tecnología e Innovación (SECIHTI), ⁵Unidad Académica de Estudios Territoriales Oaxaca, Instituto de Geografía, Universidad Nacional Autónoma de México, México, ⁶Barrio San Juan Tlatenchi, Xochimilco, ⁷Departamento Sociedad y Cultura, Grupo Procesos Culturales y Construcción Social de Alternativas, El Colegio de la Frontera Sur, Unidad Chetumal, ⁸Chajul, Selva Lacandona, Chiapas, ⁹Santo Domingo Tomaltepec, Oaxaca, ¹⁰Departamento de Ciencias Sociales, Universidad Autónoma Metropolitana Cuajimalpa, ¹¹University of Göttingen, Department of Agricultural Economics and Rural Development, Göttingen, Germany, ¹²Facultad de Arte y Diseño, Universidad Nacional Autónoma de México, ¹³Centro de Investigaciones en Diseño Industrial, Facultad de Arquitectura, Universidad Nacional Autónoma de México, ¹⁴Facultad de Ciencias, Universidad Nacional Autónoma de México

and local decision making (Olvera-Hernández et al. 2023). Rather, artists and designers have only been called upon to deliver very specific and targeted tasks but have seldom become core members of transdisciplinary teams from the early design phases.

Opportunities for more impactful transdisciplinary collaborations are particularly relevant for the case of food systems in the Global South. Power relations and flawed development paradigms have structurally shaped their un-sustainability since colonial history (Wallerstein 2011). Territories were transformed into factories of commodities to support the economic development in Europe, and their inhabitants were either enslaved, eradicated, or displaced (Alimonda 2011). Neocolonialism supports to this date the elevated per capita consumption of the Global North and dominates the narratives around economic growth and desirable development pathways in the Global South (IPBES 2019, 2022). The biocultural diversity that survived this colonization has been extracted from Indigenous peoples and local communities in the name of science and development, or discredited and replaced by new technological alternatives that boost yields at the expense of negative environmental and societal consequences (Maffi 2005). However, sustainable food systems supported by principles of sufficiency, regeneration, distribution, commons, and care have been deemed critical to support healthy communities in a post-growth world (McGreevy et al. 2022). Knowledge generation to address these challenges relies on deconstructing the colonial extraction of the local biocultural diversity and rather weaving such rich knowledges into the search for solutions targeted at addressing the needs and interests of those who directly manage and depend on the local ecosystems for their livelihoods (Toledo and Barrera-Bassols 2008).

In this paper, we describe the work of the transdisciplinary project *Cocina Colaboratorio*, in which participatory artistic and design practices, centered around the kitchen, create the conditions for and nurture transdisciplinary collectives that explore what more just and sustainable local food systems would mean, what transformative changes would be needed, and proof test interventions that could pave desirable pathways. We delineate how our project was born and established in three contrasting territories of Mexico, and the current configuration of participants. We describe how participatory artistic practices support the design and operationalization of arenas for exchange and experimentation. We present our theory of change, how it connects these arenas with individual and collective agency, and with key leverage points within local food systems. We assess the challenges faced to find common ground and depict how diverse communication strategies, a collaboration protocol, monitoring, and iterative learning have allowed us to overcome them. We present our products and outcomes, the role of funding as an enabler and obstacle, and a self-assessment of our strengths and weaknesses. In closing, we discuss how the insights gained by our team can inspire analogous collectives to nurture deeper transdisciplinary transformative research around the globe.

THE BIRTH AND DEVELOPMENT OF THE COCINA COLABORATORIO COLLECTIVE

Cocina Colaboratorio emerged from the need to bridge academic research with those who inhabit the territories where it is conducted. More than 30 years of academic research on the ecological dynamics of the Lacandon tropical rainforest in

response to land use change (Balvanera et al. 2021) have not been able to address the needs and interests of the people of the Marqués de Comillas region in Chiapas (south of Mexico). To address this gap, researchers from the National Autonomous University of Mexico (UNAM) and Wageningen University (WUR) were keen to take it a step further, in the context of a project aimed at reconciling biodiversity conservation, agricultural production, and the livelihoods of smallholders, the Forefront Programme.^[1] The international collective *Cascoland*,^[2] a network of designers, visual artists, performers, and academics based in Amsterdam, was invited to find ways to better integrate local and scientific knowledge and to generate processes and proposals that would directly engage local collaborators. *Cascoland* proposed to create a space for a transdisciplinary collective to grow and act by sharing and cooking, using participatory arts and design to promote this connection.

In early 2018, 15 people, including artists, chefs, architects, sociologists, designers, and radio and video producers, under the leadership of *Cascoland*, undertook a first pilot (Kooi and Martínez 2021). The team, based across the Lacantún River from the Montes Azules Biosphere Reserve, cooked, planted, and shared stories and meals with the inhabitants of the region for 1.5 months. During the last week, 20 academics and students from the Forefront project joined the interactions. This first phase was called the *Keepers Lab&Kitchen*.^[3]

The aim was to design and create spaces where different types of knowledge, held by local inhabitants, scientists and students, artists and designers would lead to mutual learning and unlearning through collective action (Kooi and Martínez 2021). Simple kitchen tables, where people were invited to cook together, were transformed into spaces to meet, dialogue, and exchange knowledge, visions, and needs. Food was used as a catalyst for exchange between members of the local communities, including the women and men who dedicated their time to cooking or farming, researchers, and artists, designers, and communicators. The streets were transformed into collective kitchens with improvised ovens built from waste and dirt, an old truck was turned into a mobile radio, and the emerging new recipes were printed in situ. Recipes and knowledge about the origin of edible products, the importance of food production, the contributions of the forest to people, as well as changes in the landscape and in diets were exchanged. A collaborative space for experimentation and knowledge generation was envisioned around the kitchen.

By mid-2019, a few of the artists and scientists who participated in the pilot devised a strategy to secure funding that would allow the operationalization of the ideas that had been fleshed out. The team decided to expand to three territories, nested in different biophysical and sociocultural contexts, and facing distinct sustainability challenges.^[4] Initial funding was secured through UNAM for three years, starting in 2020. Toward the end of 2020, a call for transdisciplinary projects by the Mexican Science Agency (CONAHCYT) prompted discussions with diverse teams of inhabitants in the three regions to foster co-design processes and the inclusion of more academics and artists into the collective; after a long iterative process funding started in 2022. In 2021, funding from a call by the Museum of Contemporary Art at UNAM, the University of Southern California, and the program on Mexican Agrobiodiversity by the Global Environmental Fund, supported the creation of exhibits in a gallery and in the three territories, a website, and several outreach products in 2021 and 2022.

We work today in three territories in central and southeastern Mexico. First, Loma Bonita, Chiapas, in the Lacandon forest, was founded recently (in the 1970s) because of extensionist government programs that brought people from different parts of Mexico; an important part of the population arrived later as refugees from the war in Guatemala. Pastures for cattle and some agricultural fields have quickly replaced the diverse tropical rainforest (Berget et al. 2021). Second, Santo Domingo Tomaltepec (hereafter Santo Domingo) is a Mixtec-Zapotec community nested in the central valley of Oaxaca within a semi-arid region. Food sovereignty and biocultural diversity have declined in the past decades because of the replacement of milpa (maize, beans, and squash) with alfalfa (mainly used to feed animals), outmigration, and low market prices resulting from the U.S.-Mexico Free Trade Agreement (Escobar Moreno 2006). Third, the wetlands of Xochimilco, south of Mexico City, host one of the most productive prehispanic agriculture systems, the chinampas, which are based on continuous fertilization from decaying organic matter deposited in the canals (Jiménez et al. 2020). Today, these wetlands face rapid urbanization, the withdrawal of clean water into the city, the pumping of sewage water into the canals, a growing demand for greens, and the abandonment of agricultural activities.

Currently, Cocina Colaboratorio gathers close to 100 people around the three sites. The team is composed of youth to elders, women and men, cooks, smallholders, local authorities, members of nongovernmental organizations focusing on different aspects of food systems and agroecological approaches, communicators, educators, designers, as well as researchers and students across the biophysical and social sciences and the humanities. Some have been part of the collective since the onset, others joined later, and others participate when the activities are relevant to their needs and when their time availability allows them to do so.

The development of goals, methodological approaches, conceptual underpinnings, and theory of change, as well as the design and operationalization of every activity, have been undertaken iteratively by all or part of the members of these teams at different stages as the project unravels. The project started as a vision from a small team of artists and academics and has developed in response to the needs of the inhabitants of the three territories as these gradually unfold, while at the same time navigating the guidelines and deliverables agreed upon with the funders. Leadership is gradually more distributed to the local coordinators and local leads and to those inhabitants of the territory who are more engaged with the project.

Currently, the decision-making process operates at different and simultaneous scales. The coordinating team is divided per territory and per cross-cutting roles. In each territory, one local lead is more focused on academic issues, another on artistic practices, and another is deeply familiar with the local customs and traditions. Cross-cutting coordinators include one lead on issues of transdiscipline, another one on narratives, another on logistics, as well as one overall academic and one overall artistic coordinator. Coordinators of local and thematic nodes facilitate decision making about actions, time lines, and distribution of budgets across actions within the different areas. Different sub-groups of participants take different sets of decisions. Dates for actions and for the delivery of products, as well as overall budget allocation, are agreed upon by consensus among all leads.

Those of us writing this paper on behalf of the collective, referred to as “we” hereafter, include inhabitants of Loma Bonita (R. Lombera), Santo Domingo (P. Miguel), and Xochimilco (G. A. Valdelamar), communicators (E. Guerrero), designers (M. Martínez Balvanera, E. Hernández Martínez), administrators and logistics planners (L. Rentería, F. Arreola Villa), as well as postdocs and academics in the biophysical and agronomic (L. Pérez-Volkow, R. Domínguez-Yescas, D. Hernández-Muciño, I. N. Flores Abreu, L. O. Almeida-Leñero, C. Heindorf), social (A. Cadena Roa, H. N. Roldán Rueda) and interdisciplinary sciences (P. Balvanera, A. Mesa-Jurado), and the humanities (P. Ortiz Antoraz, L. Equihua). The governance of the collective is polycentric: overall academic (P. Balvanera) and artistic (M. Martínez Balvanera) coordination is tightly linked to academic and artistic coordinators per territory (A. Cadena Roa, R. Domínguez-Yescas, D. Hernández-Muciño, E. Hernández Martínez, M. Martínez Balvanera) in collaboration with local leads (G. A. Valdelamar, P. Miguel), to thematic cross-cutting coordinators (E. Guerrero, A. Mesa-Jurado, L. Pérez-Volkow, H. N. Roldán Rueda), to operation and logistics coordinators (L. Rentería, F. Arreola Villa), and to task-related coordinators and contributors.

ARENAS FOR EXCHANGE AND EXPERIMENTATION

We chose to rely on participatory and socially engaged artistic and design practices to seed and nurture our transdisciplinary transformation process. These practices draw on a wide range of concepts and practices. We started with the theory and practice of narrative spaces, the design of physical or virtual environments that tell a story or communicate a narrative through spatial and experiential elements (e.g., Austin 2020). We drew on contemporary museology, the modern study and practice of museums, focusing on its evolving roles, practices, and interactions with society in the 21st century (e.g., Romero 2019). We built upon urban design, the practice of shaping and organizing the physical form of cities, towns, and public spaces to create functional, attractive, and sustainable environments (e.g., Baxter 2022). We tapped into social innovation, the process of developing and implementing new ideas, practices, or solutions that address social challenges and improve the well-being of communities in innovative, sustainable, and impactful ways (e.g., Alcaide Lozano et al. 2019). We called upon semiotics, the study of signs and symbols, and how they create meaning (e.g., Chandler 2007). We were inspired by political geography, a branch of human geography that studies the spatial organization of political processes and how they influence and are influenced by geographic spaces (e.g., Escobar 2008). We relied on visual anthropology, a subfield of anthropology that focuses on the study and use of visual media to understand and represent human cultures, behaviors, and experiences (e.g., El Guindi 2004). We embraced transformative pedagogy, an educational approach that focuses on empowering learners to critically examine and challenge existing beliefs, assumptions, and social structures to foster personal and societal transformation (e.g., Fujino et al. 2018). We employed communication and socially engaged participatory interventions, that is, strategies and practices that aim to involve communities and individuals in meaningful dialogue and actions to address social, cultural, or environmental issues, in the public realm (e.g., Helguera 2011).

Artistic and design practices were devised to deconstruct and reinterpret the world around us and make visible what is hidden (Ryle 2009). They contributed to leveraging the deconstruction of

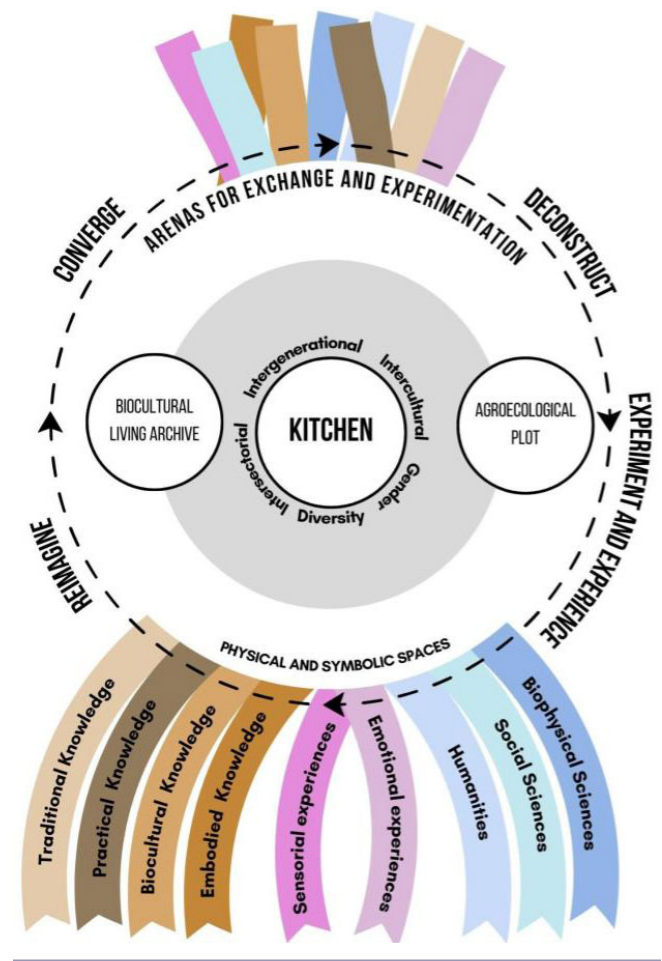
power relations among different types of knowledge, such as the presumed superiority of scholarly degrees over nonacademic knowledge, or that of analytical over embodied knowledge (Ellingson 2008, Kress 2010). Artistic practices involved all senses, sounds, tastes, movements, and forms (Mersch 2015). They interweaved the feelings, actions, and visions of the world without the use of words, beyond rational analysis (Haseman 2006, Sheikh 2009). They fostered free experimentation without any rules or replicates (Pickering 2016). Creativity was nurtured and opportunities beyond what is possible or known were opened up by creating temporary micro-utopias, in which the impossible can be experienced, by provoking what would not be done in everyday situations and triggering political agitation (Steyerl 2010, Borgdorff 2013). Artistic tools also allowed for unravelling desirable and undesirable future scenarios (Gianelli et al. 2024).

Our transdisciplinary collectives were created by and nurtured through arenas for exchange and experimentation (Fig. 1). These arenas were novel, often transient spaces inspired by daily life and local context and yet transcended the common ground to surprise, disturb, invite, and question. Arenas for exchange and experimentation were developed and operationalized to foster creativity, innovation, social interactions to dialogue, explore possibilities, and co-create solutions, through innovation labs or hackathons, for instance, for sustainability transformations purposes (Pereira et al. 2015, Kvamsås et al. 2021).

These arenas for exchange and experimentation were at the heart of the work of *Cocina Colaboratorio*, and were contextualized and operationalized so that they contributed to our transdisciplinary transformational endeavor in several ways:

- Through action, e.g., cooking, the arenas fostered exchange between the different types of knowledge, for instance, bringing traditional knowledge on how the ingredients were cooked, practical knowledge on how to set the stove, biocultural knowledge on the diversity of ingredients, and embodied knowledge on how to cook. But this also included knowledge from the biophysical sciences about the nature of climate change and its impacts on the production of the ingredients, social sciences about the drivers of change that are driving the abandonment of agriculture, and knowledge from the humanities on how identities are brought to the table and linked to the ingredients and the territory. Hereafter we refer to knowledges to convey this diversity.
- The shared activities fostered horizontal interactions involving the different cognitive, affective, and relational dimensions of the participants. For instance, ingredients were jointly harvested from the neighboring Agroecological Plot, and recipes, practical, embodied, and scientific knowledges were shared. While washing, chopping, or frying, connections among individuals were recaptured or created. The struggles to grow the ingredients, their histories, and tastes were discussed in various ways. Each participant contributed from their own experiences, backgrounds, approaches.
- By going beyond the habitual, these alternative spaces deconstruct the ways of seeing or doing, allowing the participants to experiment together, reimagine other possible futures, and gradually identify spaces of

Fig. 1. The areas for exchange and experimentation are physical and symbolic spaces that are collectively designed to weave types of knowledge, to experiment with, and ultimately to “cook” more just and sustainable futures. These arenas allow for the intertwining of different types of knowledge through shared action. They are centered around the Kitchen and include the Agroecological Plot and the Living Biocultural Archive. Within these arenas, diverse teams including people of different ages, genders, and backgrounds share actions, experiences, thoughts, and memories. Through shared experiences, the participants deconstruct dominant paradigms, experiment with new ways of doing, reimagine alternative futures, and identify areas of convergence.



convergence. For example, new combinations of ingredients were suggested by the participants and the new tastes opened up opportunities that had not been imagined. These unusual combinations and settings made visible what is taken for granted, for instance, the dominant narratives of how to produce food, what to consume, or who should cook.

- These spaces generate the logistical, spatial, and emotional conditions for people from different generations, genders, and backgrounds to arrive, stay, and get involved. They are tailored to the local ways of connecting. By exploring together the known and unknown tastes and smells,

Table 1. Our three main arenas are the kitchen, the agroecological plot, and the living biocultural archive. Each of these is characterized by unique features, specific spaces, sets of methods and actions, media, and communities of practice.

Definition	Arenas are the physical and symbolic spaces that are collectively designed to weave knowledges, to experiment, and to cook more just and sustainable futures		
Main arenas	Kitchen	Agroecological plot	Living biocultural archive
Unique attributes: what constitutes the essence of each arena	Choosing ingredients Preparing food Sharing food	Producing food using agroecological approaches Caring for and regenerating the soil Selecting and planting seeds Caring for plants (watering, controlling weeds and pests) Harvesting	Archiving and unarchiving, to share and keep alive: Physical objects (e.g., seeds, plants, agricultural tools, kitchen utensils) Knowledges, practices (e.g., recipes, ways to grow food) Narratives (memories, visions of the future) Sensory experiences (sounds, images, tastes, odors)
Spaces: where the interactions and actions take place	Personal (e.g., home) Public (e.g., plot, street, square, park, school, community kitchen)	Individual (e.g., plots owned by the same person) Communitary (e.g., school orchard, experimental plot)	All the physical spaces within the territory Physical spaces outside the territory Art galleries Virtual spaces (web pages, social media)
Activities: what actions are undertaken	Establishing a mobile kitchen Sharing utensils and ingredients Experimenting with recipes and innovating Recovering recipes, flavors, smells Washing, chopping, cooking Exchanging recipes, flavors, histories, memories, dishes	Co-designing plots and the species combinations Experimenting with different techniques Sharing knowledges (e.g., soil regeneration, planting, weed control) and sharing work	Establishing a mobile radio and producing podcasts and radio capsules Printing workshops and creative publishing Taking pictures and making participatory videos Exhibits Drifts through the territory Participatory mapping Seed exchange Mobile devices (e.g., carts, boats) Audiovisual tools Press Social network Everyday objects
Media: what resources and tools are used to achieve the actions	Infrastructure (e.g., water, fire, stove) Utensils (e.g., pots, ladles ...) Ingredients (e.g., harvested in plots or in the territory) Technologies (e.g., fermentation, nixtamalization, dehydration)	Agricultural tools (e.g., shovel, pic) Inputs: To be sown (e.g., seeds, cuttings) To regenerate the soil (e.g., compost, dung, ashes, microorganisms) To irrigate (e.g., canal, well, tank, hose) To regulate weeds and pests (e.g., soap, lime)	Mobile devices (e.g., carts, boats) Audiovisual tools Press Social network Everyday objects
Communities of practice: what collectives have been established and strengthened through this arena	Collective of builders, stewards, and cooks of the collaborative kitchen	Agroecological collective	Youth community chroniclers and stewards of the archive
Example in one of the territories	In Loma Bonita: Community kitchen that was designed and built collectively to have a shared space to gather, cook, and share	In Santo Domingo: Collective of plot owners and practitioners who gather to share work, seeds, practices, knowledges, and agricultural products	In Xochimilco: Art exhibit at a university art gallery that was expanded into the territory to archive and de-archive

participants connected with each other through the memories brought back and the emotions spurred, and allowed them to share their desires.

There were three main arenas: the Kitchen, the Agroecological Plot, and the Living Biocultural Archive. Each arena was characterized by unique features, occupied specific spaces, was structured around its own sets of methods and actions, relied on corresponding media, and gave rise to particular communities of practice (Table 1).

Our central arena of exchange and experimentation was the Kitchen. We started with the Kitchen because it is one of the most basic human spaces for exchange and daily experimentation. The Kitchen is also a metaphor for cooking interconnections and insights. It is where we cook, nurture, and share our dreams. This is the space where basic needs are met, where emotions and insights are exchanged daily, and where we take care of and nurture each other and our collectives. Here, we can recover ancient recipes, wildly combine ingredients, or deconstruct inequities by inviting men to cook and serve food to women, even

if it is unusual to do so. This is a private space within the house where we share our deepest fears and hopes. It also encompasses public spaces transformed into homey spots where we all cook, eat, and laugh together. The Kitchen, for instance, is uniquely posed to discuss ingredients and share food and fosters the convergence of interests.

In Loma Bonita, for example, the project started by setting the dining table in the streets, sharing ingredients, and on the spot creating new recipes (Fig. 2a). More recently, the participatory design and construction of a collective Kitchen was the core element to all the activities of the project (Fig. 2b). In Santo Domingo, cooking and sharing traditional dishes around the fire was the most basic social connector. In Xochimilco, mobile kitchens were installed in chinampas and public spaces where wild and surplus food from local producers were the key ingredients.

A recipe book from the three territories was self-published,^[5] including a compilation of recipes shared by the community of practice around the Kitchen of each territory. In Loma Bonita recipes were centered around learning and experimenting with

Fig. 2. The three main arenas for exchange and experimentation are tailored to the very different contexts in Loma Bonita, Chiapas (a, b), Santo Domingo Tomaltepec, Oaxaca (c, d) and the wetlands of Xochimilco, in Mexico City (e, f). (a) Kitchen- cooking in the street. (b) The physical Collaboratory Kitchen being designed. (c) The Agroecological Plot and its community of practice. (d) Youth community chroniclers. (e) The mobile radio. (f) The exhibit of the Living Biocultural Archive in an art gallery. Photo credits: Ruben Garay, Tess Plein, Emilio Hernández, Taller Comunal.



new ways of cooking local ingredients, and recipes were crafted with both local women and men in the community. In Santo Domingo recipes referred mainly to the traditional dishes that were most appreciated, which were prepared by adult women who are the traditional cooks of the community; a few of them included new recipes with ingredients collectively harvested from Agroecological Plots. In Xochimilco recipes were mostly centered around experimenting with agricultural surplus, where recipes were designed and cooked with local men and women, as well as invited guests, especially artists.

The Kitchen was connected to the experimental Agroecological Plot, where different ways of regenerating the soil, combining species, and dealing with pests and diseases were experimented with. The Agroecological Plot, whether individual or communitarian, provided a space for sharing work to plant and tend to the plants (Fig. 2c). Activities were centered around selecting what to grow, designing the layout of the plots, regenerating the soil, caring for plants, and harvesting. Each territory had its own agroecological community of practice where men and women of different ages participated.^[6]

In Loma Bonita, a food forest was established on communal land, with species that emulated forest regeneration while meeting the needs for locally appreciated plants; emphasis was given to producing bio-inputs to regenerate the soil. In Santo Domingo, the emphasis was on soil recovery, through the incorporation of biomass and diverse decomposing organisms into the soil, as well as on ways to reduce water demand given that droughts are intensifying. In Xochimilco, the knowledges and visions associated with the chinampas are being revisited in the current contexts, in the face of urbanization, water pollution, temporal peaks in food production, increasing demand for agroecological products from the city, as well as land dispossession and livelihoods associated to the urban dynamics. The knowledges collectively gathered to tend the soil, the food forest (in Loma Bonita), or the chinampa (in Xochimilco) were brought together in a series of manuals.^[7]

The Living Biocultural Archive^[8] is a dynamic museographic device that is composed of seeds, artefacts for planting or cooking them, recipes, the different knowledges, and the stories around them. This archive is alive because it is continuously fed and shared through the streets, plots, and canals. Rather than found in academic publications or in museums, it sits in private houses and wanders through public spaces. It can also be found online^[9] in a format that is accessible to a wide diversity of readers, and it models the local customs and needs (see *Archivando Memorias* in *Cocina Colaboratorio* 2024).

A three-week-long exhibit, for example, at a university-based art gallery in Xochimilco (Fig. 2f) brought together seeds (the actual seeds, their pictures, their stories), knowledges, and participants of each territory and then was showcased back in Loma Bonita, Santo Domingo, and Xochimilco, throughout 2022. The pictures of the seeds were then taken back to the three territories where they were attached to bike taxis, canoes, and carts to share audio and insights gained during the exhibit. Young participants shared the stories of the older relatives with the younger generation through audio and videos (Fig. 2d). Mobile radio stations were installed across the territories, for instance on an *acalli* (canoe) moving around the canals (Fig. 2e), to interview people and to broadcast publicly our own radio stories (Fig. 2e).

Communities of practice were established around the three arenas at each of the three territories. These communities were groups of people who shared an interest or a passion and who learned how to improve through regular interaction (as defined by Cundill et al. 2015). Participants voluntarily committed to meet for cooking, planting, or remembering stories together.

Around the arenas, communities of practice resulted in the three territories. In Loma Bonita, the co-construction of the actual collective space for cooking, connected to the food forest, was supported by the collective *Vista a la Selva*. In Santo Domingo and Xochimilco, women who hold the traditional culinary knowledge gathered to cook together and to share with the younger generations. Around the Agroecological Plot, a community of practice in Santo Domingo called *Las Caracolas* gathered mostly women, both young mothers and elders, who are concerned with providing healthy food to their children and grandchildren. In Xochimilco, the *Colectivo Mixquiahua*, was born from the need to share their knowledges around the

management of the chinampa; a network of networks made up of many collectives was also established. Around the Living Biocultural Archive, a collective of *Cronistas comunitarios* (community chroniclers) made up of young (between ages 14 and 22) has committed to documenting the stories that unfold at the different activities of the project across generations using audio and videos.^[10]

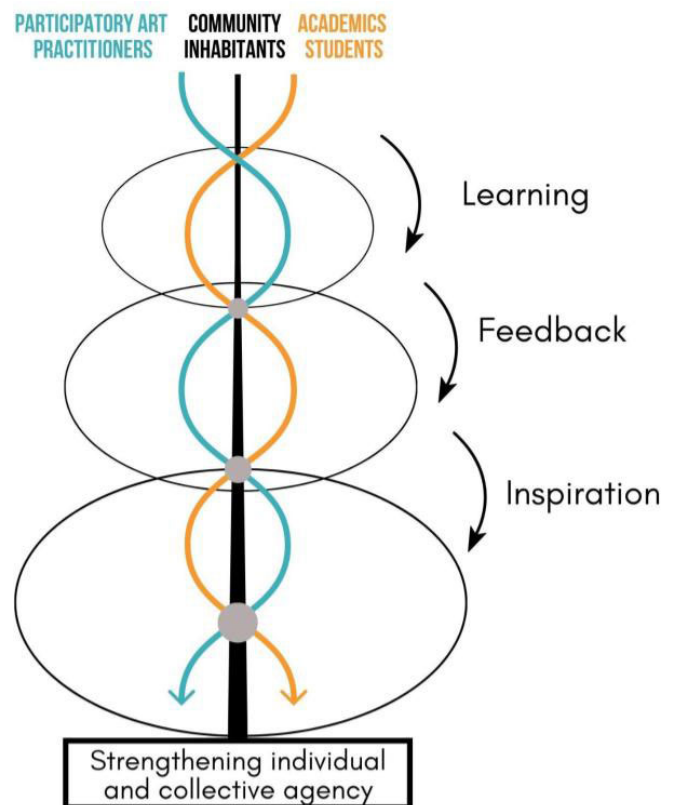
TRANSFORMATIONS: FROM THE ARENAS INTO THE LOCAL FOOD SYSTEM

Transformation occurred iteratively within and beyond the arenas for exchange and experimentation. Each action activated the previous ones, which in turn activated the following actions (Fig. 3).

- In the beginning, participatory art practitioners, students, and academics designed the encounters and convened people through a range of methods. These calls for participation involved cooking on the streets and engaging neighbors in bringing ingredients, interviewing people on radios in the streets or public plazas, and walking through the community with carts and canoes.
- Word of mouth about what happened around the Kitchen, the Agroecological Plot, or the Living Biocultural Archive spread, and some other people showed up at the next activity.
- As more people enjoyed gathering around the arenas and learning from each other, as the issues that were most pressing to the local territories were revealed, the inhabitants of the territories became more actively involved in designing and convening the next activity in the arenas.
- The participants took what they learned in the arenas to their own homes, families, and social networks. They experimented with the new recipes, planted the seeds that were just shared, and chatted about the narratives that were revealed.
- In turn, the insights gained at home fed into the next iteration of the arenas. The recipes cooked at home, the needs identified in the plots, and the stories left to be told were brought into the next iteration of activities.
- As more people became interested, they were happy to share their own kitchens or plots or more willing to participate in the next walk in the territory. Gradually, more people were inspired to engage with the project and to bring home what they had learned.

These arenas were designed to nurture intersectionality, including gender, intergenerational, and intercultural diversity (e.g., see the diversity of participants in Fig. 2). For example, women cooked privately with small teams to share joys, pains, and aspirations. Elderly farmers expressed knowledge and memories while working on their plots. Local authorities unraveled their divergent or conflicting perspectives while walking through the territory. The youth used their mobile phones or professional radio equipment to enquire about the memories of their grandparents. Academics and students explored, for example, the history of the territory, the roles of wild species, the impacts of climate change, or the relational links to the territory, while chopping, planting, or walking through the territory. They told stories through the radio. A fair of knowledge, for example, was designed to foster

Fig. 3. Arenas for exchange and experimentation are transient and allow for the convergence of the members of the transdisciplinary collective to interact. These convergences are then taken back to each other's homes where they are put into practice, and then fed back into other members of the collective, other arenas for exchange and experimentation, or other components of the food system. The insights gained inspiration from others, even beyond the three communities in which the teams are based. These processes are designed to strengthen individual and collective agency.



culinary experimentation with unusual combinations of herbs and chocolate, while parents were invited to a composting experience, a group of farmers participated in a collective map on the responses to COVID, while the radio led by the youth convened the elders to share the stories with the public (for more details see Una feria de saberes in Cocina Colaboratorio 2024).

Iterative learnings, feedback, and inspiration occurred from iterative activities in the arenas (Fig. 3). Local inhabitants, the local leading team, academics, and artists designed collectively the next action based on the needs identified during the previous action, to fine-tune the design of the spaces, methods, and media. For example, a mobile device for the Living Biocultural Archive mimicked those that were part of people's daily lives, becoming a cart in Santo Domingo or a canoe in Xochimilco, which was co-crafted with local artisans. Academics and students refined their questions and methods within and outside of the arenas. For instance, exploration of the role of edible wild species

occurred during collective walks through the territory, through individual participatory mapping exercises, and collective mapping deliberations.^[11] Translocal insights (sensu Kudo et al 2020) allowed for insights gained in one territory to be shared with the other one.

The arenas for exchange and experimentation were designed to contribute to the individual and collective transformative agency of its participants. The arenas were designed to promote the active engagement of the participants. Our understanding of the components of this transformative agency has been iteratively shifting, inspired by the current literature on (transformative) agency (Pick et al. 2007, Westley et al. 2013, van der Sande 2017, Benessaiah and Eakin 2021, Staffa et al. 2022), and then proof tested in the territories (Cadena Roa 2024). Arenas nurtured the ability of their participants to question the status quo, act, decide, express, lead, dialogue, imagine, organize, plan, and dream of alternative futures, and became agents of change, for individuals and collectives. For instance, the idea of constructing a collective Kitchen in Loma Bonita came from local inhabitants as a result of mobile cooking events. Together, with the support of a collective of participatory architects called Taller Comunal,^[12] the space was codesigned. The responsibility of finding funding was shared between local inhabitants, Cocina Colaboratorio, and Taller Comunal; common efforts were placed in finding possible donors of money, materials, expertise, and work.

These arenas were also designed to foster a sense of community (Fig. 3). Women, men, children, youth, and elders met repeatedly at the Kitchen, the Agroecological Plot, and the Living Biocultural Archive. Actions, work, emotions, food, narratives, and memories were iteratively shared. Commonalities and disagreements were identified, relationships built and strengthened, and synergies and alliances interwoven. The communities of practice for each of the arenas intersected with each other, and some inhabitants of the territories were involved in more than one community of practice and participated frequently in many of the diverse activities of the project. For example, the people involved in co-designing the collective Kitchen in Loma Bonita, also tended the food forest.

The different participants contributed their skills to make up the collective. Artists were key to the design of the different arenas and the activities within them. Communicators contributed unique skills to the mobile radio. Scientists and students explored the impacts of climate change on community narratives and local governance and synthesized these perspectives to identify key opportunities for action in conversations with the governing bodies. They also provided assessments of the most successful species consortia while cooking with the products that had been harvested more successfully. The members of the communities of practice around the Kitchen or the Agroecological Plots shared their knowledge, time, and expertise toward tending the plots, cooking, and sharing stories. Through collective action, diverse perspectives were honored. Gradually, a sense of community was built and cultivated.

Transformations toward just and sustainable futures were activated for the different components of the local food systems. To allow the identification of transformation needs, to be able to strategically plan interventions, and to monitor progress in transformations, we developed our own definition of the

components of the local food system (Fig. 4a). We used the literature on food systems as a seed (e.g., Ericksen 2008), and then through iterative discussions with different types of members of the collective, we identified four major components of the local food systems. Food production was undertaken in agricultural plots, be they large plots that used intensive agriculture, or small plots or backyards where agroecological approaches were proof-tested. Food preparation and consumption occurred mostly in the kitchens, but also on the streets, using both locally produced and outside ingredients, traditional and novel recipes, and involving people of all ages, genders, and backgrounds. Food exchange can occur within family, local, regional, national, and global networks, either through reciprocal or market transactions. Food waste can be disposed of in dumpsters or incorporated into the soil, either directly or through the production of more or less sophisticated composting techniques. Additionally, we recognized that the specific social-ecological context has shaped these components in ways that emerged through narratives shared around the fire, the plot, or in assemblies. The sets of interactions between different groups of people and the agreements between them that determine how the ways in which societies and nature shape the food systems, i.e., governance, are unveiled as the visible and nonvisible challenges to shift the status quo are explored.

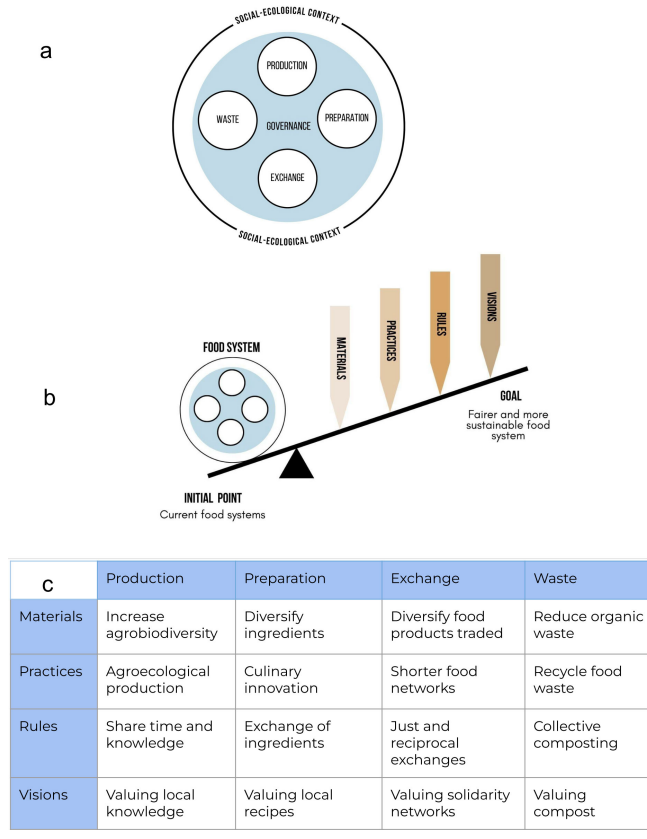
We used a leverage points approach to explore the transformations of the whole local food system. Inspired by systems complexity theory, specifically on leverage points, i.e., the key places in the systems for which small focal changes can lead to system-wide transformations (e.g. Fischer and Riechers 2019), discussions with different types of members of the collective led to the identification, proof testing, and refinement of four types of impacts (Fig. 4b). Changes in materials included those in the ingredients of the recipes at the Kitchen, those in the types of plants grown in the Agroecological Plot, or those in the diversity of seeds shared through the Living Biocultural Archives. Changes in practices referred to culinary innovations, the adoption and refinement of agroecological practices, or the promotion of new networks of exchange of agricultural products. Changes in rules (norms, agreements) occurred as men were invited to cook and women had become the leading agroecological innovators, and as cooperation within each of the arenas and through the communities of practice increased. Changes in visions referred to the questioning of dominant paradigms, such as those that support intensive agriculture or cultural homogenization, and to the exploration of alternative futures around food security and sovereignty, biocultural diversity, or the defense of the territory in the face of rapid transformations and privatizations.

We used a matrix with the four components of the food system versus the four types of impacts as a synthesis tool. This matrix is a heuristic tool for planning and monitoring at the level of the different coordination nodes and a way to summarize the results for the funders (Fig. 4c). However, it has been less useful in each of the territories as it is complex and abstract.

OUR THEORY OF CHANGE

The first iteration of our theory of change connects the problem with the ultimate goals. Our theory of change emerges from iterative collective actions and discussion (Fig. 5). It departs from the problem, highlights the key role of spaces, highlights the actions undertaken there, identifies what shifts, highlights the outcomes, all this in the context of the long term goals.

Fig. 4. Which transformations in the local food systems are more desirable, and what types of interventions are needed can be explored by identifying (a) a few components of the food system, (b) a few types of impacts, and (c) the combination of components and interventions.



The problem is the lack of sustainability in the local food systems and of just livelihoods for those who manage these food systems. Yet, the underlying challenges include unjust livelihoods for the small holder farmers who manage the land.

The spaces are the three arenas for exchange and experimentation where the transformation starts. These include the three territories in which we work.

Actions within the arenas are the trigger of the changes. Cooking, sowing, exchanging, walking, connects people with each other, sets the stage for the creation of collectives, and gets the very basic exchange going. Then, as all these actions take place, participants explore the current situation, deconstruct dominant narratives, weave knowledges, experiment with different recipes, agroecological techniques, rules to organize collectives, share memories as well as explore possible futures.

Shifts then start to kick off slowly. Within the communities of practice, individual and collective agency is mobilized. Acting together, deciding about what to do, learning from each other, dreaming of more desirable futures, planning to achieve them, and leading these efforts are triggered. In turn, these collectives act upon the food systems, and activate the different leverage

points, the materials, practices, norms (rules), and visions, linked to the different components of the food system, production, preparation, exchange, and disposal.

The outcomes of these interactions and shifts include translocal learning across sites and inspiration within, among, and beyond the collective, fostering capacities for all the members of the collective, and also inspire other territories through our products. We have produced a wide range of products for different audiences.

What is exactly the ultimate goal? A common vision of what more just and sustainable food systems mean in each territory is still in process. Consensus is emerging on the need for self-managed collectives to defend their territories and biocultural heritage, and to foster resilient livelihoods.

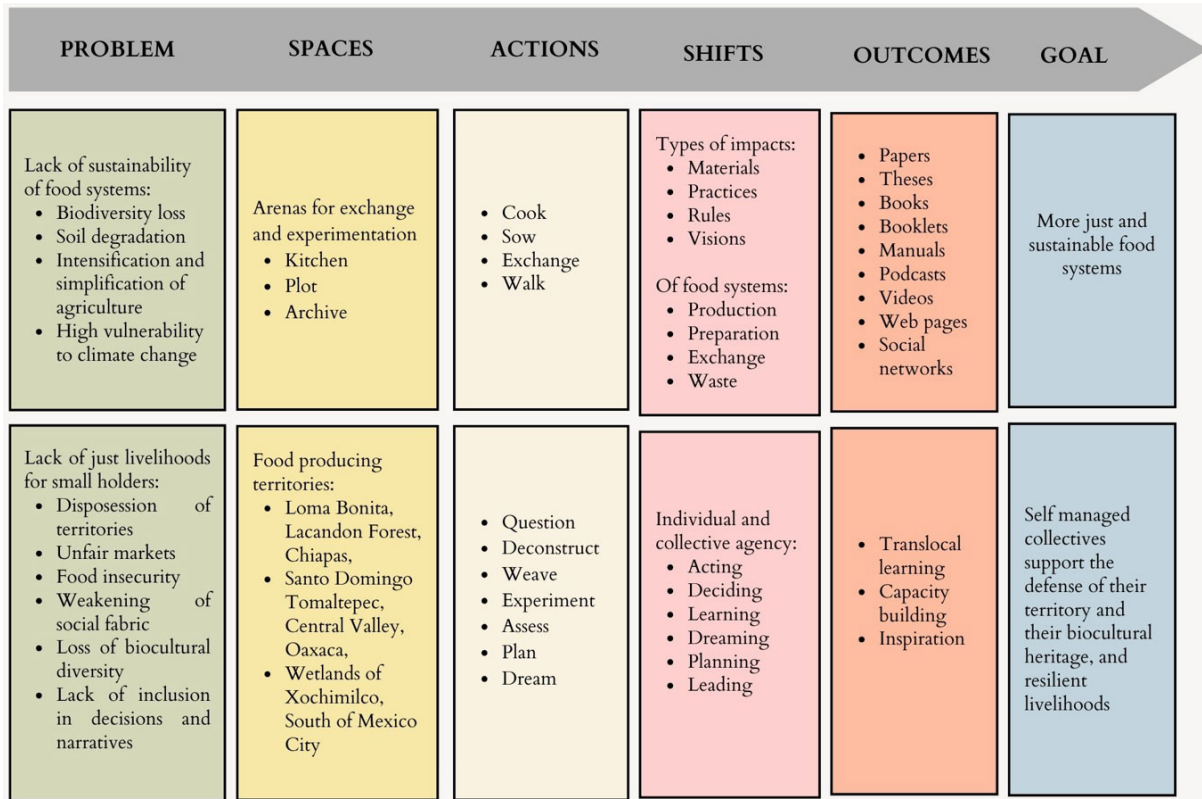
We have organized the first stages of the transformation process into three phases, recognizing, reimagining, and restructuring. Recognizing the plurality of visions, practices, and knowledge regarding food systems, as well as identifying the issues at stake, the unsustainable trends and their drivers, is undertaken through connecting deeply with the territories and their inhabitants. Reimagining more desirable futures,^[13] identifying converging aspirations, and exploring alternatives to the dominant narratives have widened the potential targets of the experimentation process. Restructuring has meant consolidating communities of practices, building collective spaces, and operationalizing strategies to reach the collective desired futures.

Monitoring is performed at each activity and is then analyzed annually. The leading team (those writing this paper) has been developing approaches to monitor transformations. To do so, we iterated back and forth, between the discussions of global literature, the insight gained within the arenas, and the collective gradual understanding of the issues that are considered as most pressing by those who inhabit the territories. Minutes are prepared after each activity or meeting by any participant of the activity and then revised by the coordination team of the corresponding territory.^[14] The minutes include information on which arenas were involved, which components of the local food systems were touched upon, what types of impacts are occurring, who participated and how, as well as what dimensions of individual and collective agency were engaged. The minutes are drafted based on the insights gained by the collectives in charge of planning the activity, those participating in it, as well as those involved in reflecting on what was learned after the activity. These minutes are then analyzed annually by the cross-cutting thematic coordinators focused on transdiscipline to assess progress so far. These results with the coordinating teams to refine planning for the following year. They also feedback on the way activities and synchronous intensive on-site periods are co-designed.

CHALLENGES TO COLLABORATION AND DEVELOPED STRATEGIES

Finding common ground was like trying to fit circles into squares. Participatory artists and designers tended to act spontaneously to emphasize sensorial and emotional experience, foster creativity, challenge the status quo by triggering unfamiliar situations, nourishing indiscipline and deconstruction, and designing the ephemeral spaces created in the arenas to become deeply moving. The inhabitants of the territories tended to emphasize embodied

Fig. 5. A first version of the theory of change of the collective Cocina Colaboratorio.



knowledge, their local practices and visions, their struggles and needs, their obstacles and enabling factors, their personal interconnections, and the urgency to identify concrete solutions that fit their local context and lived experiences. Scientists tended to emphasize analysis, rationality, complexity, theories and hypotheses, quantitative and qualitative measures, modeling, and strategic planning; they can link place-based to global generalizable knowledge, as well as processes operating beyond the individual at large spatial, temporal, and organizational scales.

Boundary languages, practices, and concepts allowed us to navigate the above differences and build joint road maps. During the COVID-19 pandemic, online workshops with those with enough familiarity and access to the internet were iteratively merged with previous data and ongoing (with very small teams) in-person activities, and with creative exchanges of audio and pictures through WhatsApp. Since 2022, each activity at any of the arenas for exchange and experimentation, has been undertaken with inhabitants of the territories, artists, and academics (researchers or students). These activities, or series of activities within an intensive synchronous on-site period, were collectively planned. For example, at the beginning of 2023, inhabitants of Santo Domingo, artistic coordinators, artists in residence, academic coordinators, postdocs, and graduate students gathered to plan for the following month of intensive activities at the territory. A map was drawn collaboratively to identify the most significant features of the territory, the components of the food system, the arenas for exchange and experimentation, the main topics of interest for the inhabitants

of Santo Domingo, and the different types of stakeholders and communities of practice. Based on this information, a preliminary agenda was designed to address the needs of the inhabitants of Santo Domingo, to weave into this context the contributions of students and postdocs (e.g., water governance in the face of climate change, and role of care in sustaining the past, present, and future), and to draw on the strengths and experiences of artists and academics (Fig. 6). For each of the planned activities, the specific spaces, methods, and media were collectively planned. At the end of each week the agenda was refined according to the lessons learned.

Frequent, inclusive, and diverse communication strategies have been developed. WhatsApp groups allow constant communication among members of the different communities of practice, the collectives in each of the territories, and the members of each lead team per site and cross-cutting issues. On-site, private meetings with community inhabitants, meetings of the planning teams, and community assemblies address different needs. Weekly to monthly virtual meetings occur across the nodes and teams, supported by Trello, Google Drive, Miro, and Zoom. This flexible organizational structure encourages broad levels of participation and connectivity, strengthening diverse opportunities for learning and experimentation.

A collaboration protocol has been advanced to put the interests and needs of the inhabitants of the three territories at the center. A protocol^[15] to ensure that the long-term collaborative vision guides the short-term participation of visiting creatives, the design or operationalization of undergraduate and graduate theses and

in-depth analyses by external consultants. The participation of external consultants, for example, has either entailed on-site visits and interviews with the inhabitants of the territory about how they perceive the project, or interviews with the coordinating teams followed by workshops to flesh out the issues and develop strategies to address them.

OUTPUTS AND OUTCOMES, ENABLERS AND OBSTACLES, STRENGTHS AND WEAKNESSES

The project has already contributed many products in diverse formats for diverse audiences. The project aimed to communicate the collective findings with a wide diversity of audiences, including the inhabitants of the three territories, analogous collectives in other territories, students and academics of diverse disciplines.^[17] Academic papers (4) have emerged from PhD theses, postdocs, and cross-cutting syntheses; for instance, we assessed the perceptions of chinampas as alternative food systems (e.g., Guibrune et al. 2023). One booklet proposes methods derived from our collective (Cocina Colaboratorio 2024), and one sharing diverse insights is underway (with 35 chapters to be finalized and published by mid 2025). Students, from undergraduate (8) to masters (10), PhD (5), as well as postdoctoral researchers (7), have undertaken their projects within Cocina Colaboratorio, and we have taught short (5) semester-long (8) courses for very diverse audiences.

Our experiences inspire the members of the collectives, the inhabitants of the three territories, and many artists, academics, non-governmental organizations, and other communities through different outreach means. Many outreach products, including papers (1), recipe books (2), agroecological manuals (5), leaflets (3), infographics (14), thematic reports (60), videos (26), podcasts (9), audio capsules (25), and 4 exhibits (one in the Nishizawa gallery and the others in each of the territories), use very diverse approaches to communicate with these diverse audiences in many different ways. We have a project-wide webpage^[4] and another one dedicated only to the Living Biocultural Archive,^[9] a YouTube channel,^[18] a Spotify podcast,^[19] a Soundcloud radio,^[20] as well as Facebook^[21] (with 1700 followers) and Instagram^[22] (5500 followers) accounts.

Our monitoring efforts to date reveal intense collective efforts:

- Numerous activities have been undertaken in the arenas of the three territories: Our activities have ventured into public (community town centers, streets, chinampas, waterways, sports facilities, schools, and local government meeting spaces) and private spaces (agricultural plots, homes including their kitchens and home gardens, and local businesses). For instance, between 2022 and 2023 we organized 89 events within the three territories; each event consisted of at least one in-person encounter, but sometimes the same event was held over two or three different days or locations. Around the Kitchen, for example, 33 events have involved 178 plant varieties as ingredients for recipes.^[23] Another 60 events were aimed at the Agroecological Plots at the different phases of the growing cycle of plants.
- Diverse participants: In the past two years, these activities have convened a total of 1400 people (not excluding the same person attending two or more events) between the three territories; most of the participants are adult inhabitants

(80%) of the territories, including both women (60%) and men (40%); teenagers and children (20%) were also convened, though less frequently; all activities have included at least one artist and one academic.

- Individual and collective agency: In the first year, we monitored agency as the sum of different capacities and rights (Pick et al. 2007). Autonomy, for instance, was fostered through co-design of activities, of the collective Kitchen in Loma Bonita, or of participatory videos. Self-determination was boosted through imaging futures and creating new narratives. As our understanding of agency evolved, we used our own set of indicators of individual and collective transformative agency (Cadena Roa 2024). As a result, we documented that the capacity to question was associated with the ability to challenge dominant paradigms; the capacity to decide was nurtured by making visible local narratives; collective learning was fostered by increasing access to high-quality information and by questioning and discussing gender-related issues; collective organization was strengthened through the communities of practice.
- Impacts on the components of food systems: Food production and consumption were the components of the food system that were more often experimented with. Food production was centered around soil regeneration through the production and application of agricultural bio-inputs. Seed exchanges were promoted in the three territories, accompanied by the agroecological communities of practice and the collective design of food forests and family parcels. Food consumption was mainly approached through collectively cooking traditional dishes as well as experimenting with wild and local species.
- Shallow and deep leverage points have been activated: The activities undertaken have activated some leverage points more than others: last year (i) 100% of the activities involving changes in vision, such as questioning dominant paradigms around food sovereignty and food security, were present in all the activities; then followed (ii) 60% of the activities involved changes in materials, such as the use of a more diverse set of local seeds, the design of novel consortiums of plants and ingredients; the third most frequent impact has been (iii) 80% of the activities involved changes in practices, such as the use of compost and plant-derived inputs to fertilize and regulate pests; finally the least frequent have been (iv) 10% of the activities involved changes in rules, such as the creation of new agreements among the members of the communities of practice to commit their time, efforts and knowledges.
- We collaborated with local authorities in two of the three territories: Direct collaboration with the local authorities was undertaken in Loma Bonita (300 inhabitants) and Santo Domingo (3000 inhabitants) localities^[24] but not in Xochimilco (with millions of inhabitants). Key steps were frequent communication, the introduction to new members of the collective, informing them of advances in current projects, delivering reports, presenting future plans, and asking for their approval before publishing any sensitive information. Especially in Santo Domingo, walking the territory together with the authorities allowed us to understand the complexities of local governance.

- Complexity thinking nurtured: At each and every activity there is an opportunity for reflection and collective thinking. For example, we have collectively built mind maps on the individual and collective strategies to cope with the impacts of COVID-19.^[25] We discussed the challenges and opportunities for more sustainable family animal husbandry.^[26] We also discussed individually then collectively on the enablers and obstacles of agroecological adoption.^[27] Through tools such as mind maps, we synthesized individual in-depth explorations of these and other topics, and then shared simplified versions of these complex diagrams with different collectives. In doing so, trade-offs and complex interactions have been revealed, and strategies to address them have been jointly co-produced.

During the past four years, the project has deeply transformed the visions and ways of doing of those most involved in the collective:

- Deconstructing extractivism: We understand extractivism as an activity centered on the needs of the person who visits a territory. Such extractivism can apply to academics, students, and artists, who only focus on completing their theses, papers, pieces of art, or videos. All participants who engage temporarily with *Cocina Colaboratorio* have been invited to reflect on why and how to undertake transdisciplinary research and what it means to become part of a long-term transformative change of the local food system with and for the local inhabitants of the communities. Early co-design of the proposed temporary participation has been key to focus them around the needs of those who inhabit the territory through identifying and responding to the practical needs of the agroecological community of practice. Emphasis has been put on the iteratively sharing, or at least once upon completion, of the results of each initiative through activities or products that are primarily aimed at those who inhabit the territories.
- Contextualizing transdisciplinary processes toward transformation: The role of the local leading team at each site has been critical toward becoming more relevant and impactful by being more deeply embedded into each of the territories. Their continuous presence has allowed iterative identification of the most pressing needs and how these change through time, such as the critical impacts of drought that were experienced in April and May 2024.^[28] It has also allowed us to understand which activities draw people's attention and which do not so much, or what days of the week and at what time during the day, all of which is very unique for each of the territories, and also changes throughout the year. For instance, it has been important to avoid scheduling activities whenever there are important events (e.g., religious, cultural, sports, elections), and to consider seasonal changes (e.g., rainy season, excessive heat, sowing and harvest periods).
- Giving enough time for processes to mature: Multiple mistakes associated with rushing either the design or operationalization of activities, or the immersion of individual projects into the needs of the collective, have paved new pathways to undertake a co-production of knowledge that addresses the local needs by bringing insights from the different team members. Planning activities way ahead, for instance, a few weeks or days in advance, allows people to fit in their personal activities to make some time for the project. Collective projects require perseverance and time.
- New approaches and methodologies: Radically different approaches, methodologies, and types of products and outcomes are being generated. A compilation of what we call "Collaborative Formulae," the nuts and bolts of transdisciplinary collaboration mediated by artistic practices in arenas for exchange experimentation, includes "recipes" for "kneading" (as in the case of bread) agreements, participatory videos, or cooking memories (*Cocina Colaboratorio* 2024). Other alternative approaches include explorations of the roles of edible wild plants that have been coupled with culinary innovations using those species that tend to be forgotten, with collective syntheses of individual participatory maps by youth, illustrations by artists and group walks through the territory to validate the results and provoke the identification of desirable futures and strategies to achieve them.^[11] In Santo Domingo, for example, given that celebrations at the community level are the backbone of social cohesion, we mimicked this principle, celebrated the biocultural biodiversity of the territory in the streets, with the local band, with close to a hundred participants of all ages and gender, in *biocultural calenda*.^[29]
- Relationships are based on care and reciprocity: These insights are prompting new relations between diverse inhabitants of the three communities, professionals with different backgrounds, and the home institutions of those with permanent positions in academia or non-governmental organizations. Care and reciprocity involve a profound empathy for the needs and feelings of each person. Procuring nutritious and enjoyable food and comfortable lodging is as important as designing methodologies prioritizing well-being over efficiency.
- Designing more meaningful activities, processes, outputs, and outcomes: We understand meaningfulness as a property describing how much something matters, is significant for someone, has a meaning, is important, or leaves a lasting, positive impression. The activities we design in each of the territories are increasingly meaningful, because the participatory artistic tools allow for connecting with the deepest aspirations, feelings, and experiences of people. This is also because they are fine-tuned through experience to suit the needs of the participants. They are more in synchrony with the needs, but also with the strengths and weaknesses of each and every participant, their different ways of being and doing. They are connected with a collective sense of purpose, of movement toward aspired futures. They activate deep leverage points, the exploration, questioning, and revisiting of the meaning of the vision on the territory and its interdependencies with people. They are also designed with the best care possible, caring for those who participate, for the process, for the results. For example, a participant from Loma Bonita burst into tears when he heard his voice in a podcast, feeling so proud that his perspectives would be heard way beyond his territory. Another participant in Santo Domingo explained that she showed up at many activities

because “you do care about us.” A postdoctoral student working in Xochimilco admired how co-designing and co-operationalizing activities in the arenas allowed for a deeper understanding of the connections between changing landscapes, food, memories, and power relations.

Funding has been both a key enabler and an obstacle. Funding needs include securing the wages of the coordination teams per site, per topic, as well as honoraria for professionals hired for targeted tasks or in residence. The challenges have been major for the case of the professional participatory artists, designers, and educators, whose time and expertise have been largely undervalued and are not easily accounted for in grant proposals. Wages for academic coordinators have been more easily secured through postdoctoral positions, as well as through the academic positions held in universities and research centers. Students count on scholarships to support living expenses but have little time available to commit to the project. Funding for continuous and for intensive synchronous on-site work is most critical and is especially costly in the case of the remote location of Loma Bonita. Other expenses include the collective design and building of the physical collective Kitchen and other permanent spaces to support lodging of incoming participants and to undertake planning activities, as well as the rent and maintenance of community Agroecological Plots. Funding from academic bodies that have supported us for already four years (a program within the National Autonomous University of Mexico^[30]) has been generous but biased toward academic products, including courses and theses. Funding from artistic bodies, allowing, for instance, for the exhibits of the Living Biocultural Archive, have been successful but quite meager (a prize from art museums in Mexico and the U.S.^[31]) A novel governmental funding scheme for projects that explicitly link research and impact to foster the sustainability of social-ecological systems (by the Mexican Science Governmental Agency^[32]) has supported the co-production of the proposal centered around the needs of those inhabiting the territories and of the tools to navigate our challenges; it provides a reliable source of funding to meet our needs for three years, but the administrative burden has nevertheless been huge, for instance, associated to the need for official invoices in places where all the local economy is informal.

A team self-assessment identified some of our strengths and weaknesses. In October 2022, we analyzed the minutes from the 24 events organized that year, as well as 15 online anonymous surveys applied to close collaborators and to the members of the leading team (Mesa-Jurado et al. 2023). The online survey was designed to investigate participants’ opinions regarding the integration of different voices, horizontality, and transformations. These three main themes were chosen to further explore the main hindrances of our transdisciplinary process. The diversity, in terms of age, gender, personal context, type of knowledge, and epistemology, was considered a strength that supports the activities at the arenas. Self-care and community care, both in-person and during virtual interactions, was deemed relevant to support strong interpersonal interactions based on empathy and respect. The development of diverse methodologies and tools to integrate the different ways of knowing, doing, and learning, was recognized as a strength. Adaptation and flexibility in the face of unexpected situations was deemed critical. However, some challenges and tensions were identified with respect to agreement-building, language, and inclusive and plural participation.

Integration has been best during synchronous field work, but tensions have occurred when deadlines and resource restrictions put the team under pressure. Each community, participant, and activity has its own rhythm; a better consideration of these differences can reduce tensions. Local needs can be overshadowed by meeting demands from funders; collective agreements can favor participants with dominant personalities or alliances among a few team members; compassionate leadership, i.e., focusing on relationships and empathy, at each coordination node and role definition have helped to overcome these hindrances. More space and time to imagine, discuss, and propose changes in how to foster collaborative work is needed to better honor our diversities and address frustrations and conflicts. Further explorations are needed to explicitly recognize and address the power dynamics between the members of the collectives, and within the different coordination nodes.

BEYOND COCINA COLABORATORIO

The transdisciplinary collaborations undertaken by Cocina Colaboratorio highlight the huge potential of participatory artistic and design practices when considered as a foundational element and not just a nice addition. Many of the challenges associated with inadequately addressing power relations (Turnhout et al. 2020), biased consideration of diverse knowledge (IPBES 2022), relational approaches supported by communities of care (Staffa et al. 2022), and the need for more democratic and decolonial approaches to science (Manuel-Navarrete et al. 2021) are being addressed, of course gradually, by these practices. Early collaborations between scientists and participatory artists and designers can enrich current efforts to foster transformation labs or T-Labs (Pereira et al. 2021), the reframing of dominant narratives (Charli-Joseph et al. 2023), and the explorations of different pathways to amplify successful sustainability initiatives (Bennett et al. 2021). Examples from the Global South are particularly relevant to enriching global opportunities for navigating toward more just, thriving, and sustainable futures (Balvanera et al. 2017a, Nagendra 2018).

Through time, from the lessons learned by this and other analogous transdisciplinary collectives, new sets of co-production (Balvanera et al. 2017b, Norström et al. 2020) principles could be produced. These principles would support more meaningful collaborations through participatory artistic practices, aimed at countering the extractive tendency of scientific endeavor and rather democratizing knowledge (Arocena et al. 2018), fostering the political impact of transformative science (Horcea-Milcu et al. 2020), and nurturing individual and collective agency (Benessaiah and Eakin 2021). We are striving for the development of an affective approach to transdisciplinary transformations, one that connects each individual more deeply with all the dimensions of people’s everyday experience, that is supported by care and love, that can seamlessly weave the different knowledges and layers of human experience, and that allows collective efforts to truly matter.

Cocina Colaboratorio was born six years ago from a vision to better connect science with the people who live in the territories where knowledge is gathered through participatory artistic practices. The establishment phases were quite rough, facing huge challenges associated with finding funding, building trust, understanding the needs of each territory, but above all, understanding what the project was really about. Our unique

features are the arenas for exchange and experimentation have laid the ground for a gradual and caring flourishing of the strengths of each participant and collective, through undertaking simple tasks that nurture life such as cooking, planting, or telling stories. The arenas have allowed for opening up space to the deepest felt needs and aspirations of the inhabitants of Loma Bonita, Santo Domingo, and Xochimilco, and for using and developing approaches and tools from academia that contribute in more meaningful ways to foster system-wide transformations of local food systems.

Collective action, learning, and inspiration within, among, and beyond Loma Bonita, Santo Domingo, and Xochimilco is key to guiding transformative changes toward more just and sustainable food systems. Cocina Laboratorio relies on a trans-local learning approach based on iterative learning through synchronous intensive onsite activities of diverse team members (Kudo et al. 2020). This has allowed us to tune into the local needs and weave in the different ways of knowing, doing, and being. However, such endeavor requires substantial time commitment and financial resources for which academic and artistic institutions are not yet well suited. The insights gained within our collectives, which could be considered good seeds of the Anthropocene (Bennett et al. 2016), are also being disseminated in ways that foster learning and inspiration (Bennett et al. 2021) in other analogous places in the Global South and around the world, and can inform regional- and global-level explorations of pathways toward sustainability. Our deepest aspiration is that meaningful transformative change happens at our three sites to address local needs while contributing to global sustainability.

- [1] Forefront Program <https://www.wur.nl/en/project/forefront.htm>
- [2] Cascoland <http://cascoland.com/#/>
- [3] Keepers Lab&Kitchen Video <https://www.youtube.com/watch?v=L-OWvJ72kVA>
- [4] Cocina Laboratorio <https://colaboratorykitchen.com/>
- [5] Recipe book <https://attachments.arenas.net/22172058/55d1c787c-2a41cfa054918aa48ee3838.pdf?1686223256>
- [6] Agroecological community of practice report https://drive.google.com/file/d/10hLzXBSdZrHim4mp4KU3x_Rm-XOIP15M/view
- [7] Chinampa Manual <https://attachments.arenas.net/24996796/8f4c-fe35c29e1dddb6153e7c4bee3c0c6.pdf?1701374711>; Food Forest Manual <https://attachments.arenas.net/24992946/3c447f48489bb9b-694ed9f9aa2521587.pdf?1701363006>; Soil Regeneration Manual <https://attachments.arenas.net/22171889/193dd73ab7d3d9cfc20bf088084d0e06.pdf?1686221916>
- [8] Living Biocultural Archive Report https://drive.google.com/file/d/1h0x6gfjhrs70MWP_raqG83k_FbJP_ZNt/view
- [9] Living Biocultural Archive Web Page <https://archivo.bio/>
- [10] Cronistas Comunitarios Podcast <https://open.spotify.com/episode/4wRgu9JyydRiuh4MF1CnXd?si=ChKFfpe0RUCntKhW8GFPPhg>
- [11] Domínguez, Reyna, postdoctoral project. Photo by Rubén Garay https://drive.google.com/file/d/12GxCi2MEofW5TUUW8-L5HK87mbrgwiCj_/view
- [12] Comunal: Taller Arquitectura <https://www.comunaltaller.com/>
- [13] Desirable collective futures report <https://attachments.arenas.net/28224259/d9ed2760f1e58d73ff8de10c424f300f.pdf?1716319434>

- [14] Minutes form https://drive.google.com/file/d/1SuyL_rJ4TjEtD-XEmJpfdOFaIm6-seRKA/view
- [15] The collaboration protocol was developed in 2022. Every person, i.e., student, postdoc, artist, who does not live in any of the territories and who joins the transdisciplinary collective (temporarily or permanently) is requested to read, and if in agreement, sign our collaboration protocol. The protocol includes a foreword describing why we need it, how we developed it, the main axes of commitment (with the inhabitants of the territory, the data archiving policy and coauthorship, outreach products), as well as a COVID protocol.
- [16] 2022 Annual Reunion https://drive.google.com/file/d/1ADu5kRY85aCp-iWFH4mJmD431NmQAxzi/view?usp=drive_link
- [17] Project Repository <https://www.iies.unam.mx/proyectos/SistemasSocioecologicos/>
- [18] YouTube Cocina Laboratorio <https://www.youtube.com/@cocinacolaboratorio6577>
- [19] Radio Cocina Laboratorio <https://open.spotify.com/show/6oz1y6uos4iRy5FyArkbRn?si=f7adeea4e81e4125&nd=1&dlsi=ec4787c99eaa488f>
- [20] Soundcloud Cocina Laboratorio <https://soundcloud.com/colabkitchenradio>
- [21] Facebook Cocina Laboratorio <https://www.facebook.com/CocinaCoLaboratorio>
- [22] Instagram Cocina Laboratorio https://www.instagram.com/cocina_colaboratorio/?utm_source=ig_web_button_share_sheet&igsh
- [23] Collective kitchen activities https://drive.google.com/file/d/1XLEB1584lvkXVZfoU1jhX8VS0rNpIO9I/view?usp=drive_link
- [24] Local authorities in the case of Loma Bonita involve municipal and ejidal authorities (Berget et al. 2021) and in the case of Santo Domingo involve municipal, ejidal, and communal authorities.
- [25] Infographics on the role of biodiversity in addressing abrupt changes, Claudia Heindorf https://drive.google.com/file/d/15iw6fBmzyszin2NDXfxPGB5xqzLrpIm1/view?usp=drive_link
- [26] Abiael Illescas MSc Report <https://drive.google.com/file/d/1AbiewCVLzy0y9e6kwhD7c87mqRkrLqVU/view?usp=sharing>
- [27] Gabriela García, Postdoctoral researcher, page 28: <https://www.flipsnack.com/8D6766CC5A8/volumen-4-n-mero-6-2024/full-view.html>
- [28] Water Summit. Photo by Markus Martínez Burman <https://drive.google.com/file/d/1Ij4Ro9H1Gha7JpnWqY8uQqpKwTdpEc/view>
- [29] Biocultural Celebration. Photo by Rubén Garay <https://drive.google.com/file/d/10UEZ-OEXwP1EsumHknM0dm9csuRtVPeE/view>
- [30] PAPIIT <https://dgapa.unam.mx/index.php/impulso-a-la-investigacion/papiit>
- [31] William Bullock Prize <https://muac.unam.mx/programa/convocatoria-premio-william-bullock>
- [32] PRONACE <https://secihti.mx/pronaces/pronaces-sistemas-socioecologicos/>

Acknowledgments:

This work would have no reason to exist and could not have been undertaken without the enthusiasm, friendship, warm support, and co-production by many inhabitants of Loma Bonita, Santo Domingo, and Xochimilco. The authors thank all the students, academics, and

practitioners who were involved in the activities of the project. Funding was obtained through the INREF-FOREFRONT project at Wageningen University, the Programme for Research and Technological Innovation (PAPIIT) of the National Autonomous University of Mexico (UNAM) through grant numbers PAPIIT E IV200120 2020-2022 and IG201224, the Mexican Council for Humanities, Science and Technology (CONAHCYT) through the National Strategic Programme (PRONACE) on Social-Ecological Systems and Sustainability (Sistemas Socioecológicos y Sustentabilidad) through grant number F003-2022-319065 2022-2024 through the Global Environmental Fund project 9380 for Mexican Agrobiodiversity granted to the National Commission on the knowledge and Study of Biodiversity (CONABIO), and the William Bullock price granted by the University of South Carolina Fisher Museum and the Museum of Contemporary Art of UNAM.

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