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Building an Agroecology Knowledge Network for Agrobiodiversity Conservation

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Abstract: This paper describes the development of a transdisciplinary knowledge network dedicated to supporting agroecology knowledge exchange and capacity building that is particularly focused on the sustainable use and conservation of agrobiodiversity. The network—Fostering Effective Agroecology for Sustainable Transformation, or FEAST—includes nodes in Brazil, Cuba, Mexico, and Canada’s Northwest Territories and has been engaged in Participatory Action Research activities since 2015. This paper examines the development of the network over time, including a workshop held in 2019 in and around Curitiba, Brazil, and reflects on the outcomes of knowledge exchange activities. We discuss how the development of the FEAST network has informed participants’ local practice and their sense of belonging to a larger-scale, international movement for agroecology, agrobiodiversity conservation, and food system sustainability.



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1. Introduction

Against a backdrop of intertwined crises—including poverty, food insecurity, biodiversity loss, pandemics, and climate change—smallholder farmers around the world are finding ways to resist the lock-ins of the industrialized food system [1] and enact alternatives that foster economic viability, ecological regeneration, and social justice. The focus on small-scale family farmers and traditional and Indigenous communities within food and agroecosystems is important as these local actors bear significant responsibility for regional food security, often providing the majority of fresh food products to local markets (with some estimates reaching as much as 80% of the world’s food [2,3]). They simultaneously play an exceptionally important role in meeting regional, national, and international demands related to forest and agrobiodiversity conservation and climate mitigation strategies. This is particularly true for Indigenous and traditional communities who have maintained agroecosystems with a wide diversity of crops, forests, and landscapes [4]. Thus, small-scale family farmers and traditional communities are at the forefront of resistance to the industrial agricultural system, offering alternative ways of knowing and practicing agriculture that are increasingly necessary to feed the world’s growing population and to foster resilience in the face of changing climates and other shocks. They achieve this by continuing systems that are inherently complex, biodiverse, socially just, energy efficient, and that support strategies of food sovereignty [5].

While there are many avenues for such efforts to take, one framework that offers significant promise and has been gaining increased traction in recent years is that of agroecology. Defined as “a science, a social movement and a practice” [6], agroecology “has moved from being an ecology-based discipline, defined by five principles (i.e., efficiency, diversity, synergies, natural regulation and recycling), to being a broader, multidimensional concept that requires additional principles to be defined, such as those in the realm of social, political and economic disciplines and dimensions” [7] (p. 231). It is a uniquely holistic approach to food systems that includes a triple focus on: (1) specific food and fibre production practices designed to enhance agroecosystem health over the long term; (2) research and innovation systems that incorporate both western scientific methods and traditional, Indigenous, and local knowledges; and (3) collective action to shift power dynamics and push for systemic food system change in policy and institutional spheres. As a result, agroecology is today widely considered to have the potential to bring about the transformative change necessary to address the issues facing our current food system [7–9].

Although agroecology has a long history, particularly in Latin America and other parts of the Global South [10], it has become increasingly recognized at a global scale, for example by the FAO [11–13], High Level Panel of Experts [14], and the Committee on World Food Security [15]. As the COVID-19 pandemic has highlighted the many weaknesses of our food systems, as well as the particular vulnerabilities of smallholder farmers, the relevance of agroecology has only increased. With its emphasis on farmer-led innovation [16–19], closed-loop systems and knowledge-intensive (as opposed to input-intensive) practices [20], biodiversity conservation [21–26], and general socio-ecological resilience [4,13,27,28], it offers opportunities to mitigate future uncertainties related to climate shocks, loss of agrobiodiversity, pandemics, natural disasters, and their disruption to food and agricultural systems.

Despite this recent focus on agroecology as a solution to address current food and climate crises, discussions on how to integrate farmers and researchers into networks of knowledge to support and sustain agroecology from the local to the global scale are needed. Thus, this paper examines some of the key elements, challenges, and considerations that are necessary in developing agroecology knowledge networks that include small-scale farmers and traditional and Indigenous communities, as well as local practitioners, researchers, extension workers, and other social actors. We provide a reflective analysis on the development of one such network, Fostering Effective Agroecology for Sustainable Transformation, or FEAST, which includes nodes in Brazil, Cuba, Mexico, and Canada’s Northwest Territories. This network and its nodes have been engaged in Participatory Action Research activities since 2015. First, we provide a literature review regarding knowledge exchange as an essential element of agroecology and the importance of supporting networks of knowledge across a range of scales. We then consider the outcomes and results of the FEAST network and reflect on some of the issues and challenges we have faced throughout this process. We offer some insights from the lessons learned and consider how agroecological networks working across scales can begin to address issues of conservation, while supporting food security and farmer autonomy.

2. Theoretical Framework: Knowledge Networks as Key to Advancing Agroecology

Because of the knowledge-intensive nature of agroecological practice, effective learning processes are an essential element of agroecological capacity-building and transformation. Pimbert [20] (p. 12) explains that agroecological knowledge production and exchange must be “developed through respectful intercultural dialogue between scientists and farmers/citizens, building on peoples’ local priorities, knowledge and capacity to innovate”. Further, different ways of knowing must be considered and incorporated into new and emergent knowledges, including local and Indigenous ecological knowledges [29]. There must also be an awareness of how knowledge is conveyed and shared beyond conventional academic avenues, for example through narratives, oral histories, and storytelling [30]. Indeed, one of the challenges—and opportunities—of agroecology is to disrupt the power

dynamics around knowledge, as the field is still very much rooted in Western science [31] and academic knowledge can still be valued above all others [32].

Bendfeldt et al. [33] (p. 138) argue that a common approach in food systems and natural resource conservation is technical-oriented “best management practice”, resulting in the perception that systemic change is logical, linear, and sequential. However, “an overemphasis on technocratic problem solving apart from an overall systems approach does not adequately bring to light the interdependence and depth of socio-eco relations within food and agriculture. . . barely scratch[ing] the surface of farmers’ complex knowledge base, and overlook[ing] the deeply rooted hidden assets of resiliency, sustainability, and social activism that are embedded in farmer’s everyday lives” [33] (p. 139). Thus, finding ways to truly and effectively integrate different ways of knowing is at the core of agroecological practice. Eidt et al. [34] (p. 356) explain that

Knowledge integration describes a situation in which an established body of knowledge is combined with and modified by knowledge from another source, either another existing body of knowledge or newly developed knowledge. A first step in achieving knowledge integration is knowledge communication and sharing across scales, from the international, regional, and national levels to the farmer level, as well as across a broad array of disciplines and sectors.

Two concepts emphasized here, communication and emergent knowledges, are important. Communication implies the use of some sort of network for knowledge integration to occur. Pasquini and Alexander [35] (p. 113) offer a similar understanding of knowledge integration when they explain, “There is recognition that knowledge is a social process, and knowledge systems must be viewed not as single stock or store but in terms of the many actors and networks of actors through which technical and social information is communicated and negotiated”. In this sense, not only does information need to be communicated, but it must include a process in which various people negotiate its meaning. Nerbonne and Lentz [36] also view knowledge generation as a social process. What is key is that knowledge integration and generation involve the cooperation of many actors and as such, the knowledge is co-produced [37]. Thus, what needs to be achieved is not the domination of one type of knowledge over another, but rather, a dialogue between them (drawing on [20,31]).

Another fundamental concept is that of emergent knowledges resulting from the interaction between a wide range of local actors, stakeholders, policy makers, and scientists, among many others. Knowledge co-creation and sharing is one of the ten elements of agroecology that underscores the importance of “transdisciplinary engagement that may facilitate the blending of knowledge from different actors, including traditional and indigenous knowledge on agricultural biodiversity and management experience for specific contexts held by men and women, practical knowledge of producers and traders related to markets, and global scientific knowledge and practices” [7] (p. 234). From this, agroecological approaches must consider that knowledge is not static but rather dynamic and always in a process of renovation through the integration of new and traditional practices, innovations, and in dialogue with changing socioenvironmental contexts.

Agroecology differs both from conventional, high-input agriculture (i.e., agricultural practices grounded in industrial principles of monocrop, industrial-scale production with reliance on external inputs [20]), as well as other approaches to agrobiodiversity conservation, as it is necessarily based on the sharing and co-creation of knowledge. As Warner [38] (p. 3) explains, “agroecology can be effectively put into action only when networks of farmers and scientists learn together about the local ecological conditions. Agroecology cannot be “transferred” in the way that a chemical or a mechanical technology can; it must be facilitated by social learning”. The idea of social learning is one that is emphasized by a variety of scholars [21,26,36,38–41], and it focuses on the “participatory processes of social change” through which the integration of different forms of knowledge enables actors to “change their minds’ through critical thinking, interactions and dialogue with others” [26] (p. 476). For example, Anderson et al. [9] (p. 531) look beyond individual learning to

explore “the meaning, practices and potentials of “transformative agroecology learning” as a collective strategy for food system transformation”. In conventional agricultural systems, there has been a historic and continued focus on technology transfer and standardization as a means of simplification (of crops, knowledge, and/or “best” practices), generally discovered and perfected in research institutions [42]. While this transfer of knowledge is a social process, it is one that limits debate and critical thinking, effectively denying the lived experiences of farmers and the relationship they have with their environment particularly among small-scale farmers and traditional and Indigenous communities [33,43]. This “epistemicide” reduces complex knowledge systems and the environment in which they occur to simplified models that threaten landscapes and silence other epistemologies and ways of thinking [42]. In this sense, learning in agroecology is connected to broader food system and conservation issues that require us to rethink dominant paradigms of capitalist agriculture, rural development, and resource management.

Barrios et al. [7] (p. 241) conclude that:

There is a need to develop or adapt methodological tools to facilitate integrative thinking and co-creation processes that recognize the value of linking ecological sciences with social sciences, incorporate knowledge that may originate outside of conventional paradigms of science, and embrace culture and food traditions [and conservation] through participatory and action-oriented approaches to research.

In this context, knowledge networks emerge as a means to facilitate not only the co-creation and communication of emergent knowledges but also to support the development of innovation and communities of practice centered around agroecological practices. However, like the need to reject linear thinking in terms of systemic change, knowledge networks challenge the idea that knowledge flows linearly from scientists, to extensionists, to farmers and community members. As Sutherland et al. [44] (p. 429) point out, “innovation and up-take of new farming technologies or practices are widely accepted as resulting from iterative engagement in non-linear knowledge networks or systems [as] tacit knowledge most easily spreads within social networks, which enable the collective sharing of ideas and activities for common aims”. Such networks necessarily rely on social capital or communities of practice, which are based on strong ties, shared values, and/or close personal relationships. These communities are key, as the communities within which farmers participate have an impact on their decision making [45]. Thus, while knowledge about agroecology might be readily available, the context within which the knowledge is shared, i.e., through a community of practice or social network, is equally important in terms of uptake [46]. But knowledge networks can also incorporate actors connected through decentralised networks or those from outside the community of practice, thus associating knowledge and practices from outside the group, for example researchers and extensionists, and enabling potential innovation [44].

Much of the engagement with local knowledge networks that connects researchers with farmers and other stakeholders, involves Participatory Action Research (PAR), which involves a range of methodologies to ensure real and meaningful engagement with local communities and actors, guaranteeing they remain beneficiaries of the process. As defined by Méndez et al. [47] (p. 5) “Participatory action research (PAR) and related approaches seek to involve a diversity of actors as active participants in a cyclical, iterative process that integrates research, reflection, and action, and which seeks to include or amplify those voices that have been traditionally excluded from the research process”. One of the goals of PAR is to consider and incorporate “the complexity of social relations, especially related to inequity and marginality in social systems, to generate collective solutions to everyday life problems” [48] (p. 143). Initiatives such as farmer-to-farmer knowledge-sharing workshops, farmer-led research, focus groups, and community consultations help to build trust and relationships across the knowledge network, enabling the co-creation of knowledge across multiple actors and perspectives. Such methods also help to break down the dominant paradigms of academic research by empowering local actors to be involved in all stages of the research process, including defining the questions to be addressed, and democratize

processes of research and social change by ensuring that a diversity of knowledge systems and voices are included, valued, and heard [47].

Considering its focus on the specificities of food systems within their local environments, agroecological knowledge exchange is generally concentrated on the local scale. This micro focus is important given that agroecology is contextual and seeks to be place-based and relevant to communities. However, in an increasingly globalized world, it is also important to scale up knowledge exchange to understand the implications of agroecology as a practice and a movement worldwide. Sousa et al. [49] and Wyckhuys et al. [25] have argued that future research should expand on the notion of knowledge exchange for agroecology in the specific context of increased globalization via digital means of communication. Digital communication tools, apps, and platforms are making such exchange easier and more accessible, which can enable effective knowledge exchange across scales, from the local to the global. This is particularly important considering that the majority of policy discussions, programs, and incentives geared toward increasing or supporting agroecological production to address global concerns around biodiversity loss and deforestation, food security, changing climates, pandemics, among other shocks, occur at the international level, with institutions like the FAO and International Assessment of Agricultural Knowledge, Science, and Technology for Development (IAASTD) championing these discussions. However, such policies and programs face the challenge of remaining relevant across all scales, particularly considering the local, place-based focus of agroecological production. Meanwhile, the multitude of place-based case studies and initiatives being developed and supported around the world suggest that despite the specificities of each context, there are a range of common challenges and potentialities that can be incorporated into wider scale agroecology discussions. As Blay-Palmer et al. [50] (p. 29) point out “pressures at the global scale require the adoption of a sustainable food systems perspective to devise concrete solutions for localities and regions. . . . On the one hand, it is argued that they need to be place-based to enable communities to identify their specific needs, build on their collective assets, respect traditional diets and mobilize appropriate resources. On the other hand, . . . supportive meta-scale structures are also needed as a framework for facilitating change”. Thus, the development of international knowledge networks that connect local, regional, national, and international initiatives can offer insights at the global policy level, while also providing local communities and actors with innovation, solidarity, and communities of practice that transcend cultural and linguistic divisions.

One of the ways to achieve international knowledge exchange is through social networks as they can facilitate knowledge sharing between individuals who are not necessarily geographically or socially proximal. For example, using a social network analysis, Isaac et al. [51] examined the role of migrant farmers and the types of agroecosystem management practices embedded in information networks. They found that a diffuse information network, the cohesion of which is dependent on a few strategic bridging ties initiated by migrant farmers who are centrally positioned to exchange agroecosystem management practices between geographically and socially distant groups, is especially effective at supporting the adoption of agroecological innovations [51] (p. 55). This study demonstrates how distinct social groups can be linked in the exchange of knowledge and underscores the importance of recognizing the diversity between different sets of farmers in the same area.

One of the key concepts in the construction of agroecology knowledge exchange networks is a focus on the principles of agroecology, so that farmers can better incorporate them into their overall lifestyle choices and that wider-scale discussions maintain relevance across scales. For example, La Via Campesina’s methodology for developing international agroecological networks focuses on scaling up by fostering networks that can self-organize and develop emerging processes that are culturally and environmentally specific yet are connected across scales through cooperation and solidarity [52]. Cody [53], examining the Multinational Exchange for Sustainable Agriculture (MESA) program, found that the most valuable element of this international agricultural exchange was not the interchange

of agricultural innovations themselves, but the ways in which cross-cultural experiential learning promoted critical reflection in the participants. In this sense, it was more so the ideas of change that were most valuable to the farmers.

With a focus on the principles of agroecology and the idea of offering opportunities to participate and experience such learning, the FEAST knowledge network was born. This network is made up of researchers, practitioners, small-scale farmers, Indigenous communities, and civil society organizations currently working across five regions around the world: Southern Paraná, Brazil; Northwest Territories, Canada; Chapingo, Mexico; Pinar del Río, Cuba; and Rongo, Kenya. Herein, we discuss the development of this knowledge network since its inception in 2015 and consider some of the challenges faced, opportunities, and take-aways of fostering global–local knowledge sharing and communication around agroecological and conservation practices.

3. Materials and Methods

Building the FEAST Knowledge Network

As a science, agroecology is inherently both inter- and transdisciplinary, as it draws on elements of ecology, agronomy, sociology, and economics, among others, and is grounded in the meaningful participation of community-based actors and application in the real world. And yet, much of the research that has been carried out to date on agroecology has been conducted, at least to some extent, in silos (geographic, disciplinary, researcher-practice-policy). The need to develop truly transdisciplinary research and outreach was made clear when the FEAST network began to solidify in 2015. From its inception, the network has been grounded in community-identified priorities, and our research is directly informed by local stakeholders and farmers in a process of knowledge co-creation and collaborative application. The participatory nature of the FEAST network is an integral component of its intellectual merit.

In 2015, responding to a call for proposals from the International Social Science Committee, a group of researchers from several Canadian institutions leveraged their extensive international networks to bring together researchers and practitioners addressing transformative change and biodiversity conservation through sustainable food systems, agroforestry, and agroecology. In this initial phase of network development, representatives from projects in Brazil, Kenya, Mexico, and Canada’s Northwest Territories (NWT) met in Waterloo, Canada, for a multi-day strategic planning workshop with the joint goals of developing a full proposal for the ISSC and fomenting relationships across projects. During this workshop, a number of connections were identified across the range of diverse cultural and environmental contexts represented, including resilience to climate change, engaging women and youth meaningfully in social innovation related to agroecological food production, and valuing traditional knowledge and practices in policy, research, and outreach. By the time the gathering reached its conclusion, it was clear that there was a strong interest in building a collaborative, transnational knowledge network comprised of researchers from across the sciences, humanities, and social sciences, as well as practitioners and local actors, who could connect their wide-ranging, holistic, action-oriented projects, offering opportunities for knowledge co-creation and capacity-building, under the moniker FEAST. Initially, this stood for Food: Engaging in Action for Sustainable Transformation; however, as the network evolved, it began to focus more explicitly on agroecology (including agroforestry) and today the initials stand for Fostering Effective Agroecology for Sustainable Transformation.

Since 2015, the FEAST network has solidified around the research, actions, and local engagement of each of the co-authors on this paper and has expanded to include partners in Cuba and most recently Kenya. All research nodes involved in the FEAST network adhere to the principles of Participatory Action Research (PAR), which “aims to solve pertinent problems in a given context through democratic inquiry in which professional researchers collaborate with local stakeholders to seek and enact solutions to problems of major importance to the stakeholders” [54]. The research in each node includes a wide range

of PAR methodologies, from oral environmental histories and documenting traditional ecological knowledge, to farmer-led research initiatives, to community mapping and developing collaborative digital media. Such approaches disrupt colonial and conventional paradigms of agricultural research and extension and reinforce the shared authority of knowledge creation and communication.

We have continued to connect through a variety of events and activities aimed at fostering collaborative relationships and knowledge-exchange. For example, in 2016, the group organized an International Agroecology Field School designed to highlight south-north knowledge sharing, under the umbrella of the FLEdGE project (fledgerresearch.com), funded by Canada's Social Sciences and Humanities Research Council. That three-day event included research presentations, as well as practical demonstrations of innovative agroecological techniques from Cuba, Honduras, and Mexico, along with field visits to a number of agroecological farms in southwestern Ontario. A follow-up field school was held in 2018 in the Ottawa, Ontario region that included experts from Cuba and Brazil, as well as a focus on Indigenous food production in Canada. These two events, along with continuous virtual communication, the development of several funding proposals, and various ongoing projects that involved smaller-scale collaborations amongst some FEAST partners, served as precursors to the workshop held in and around Curitiba, Brazil, in 2019.

The FEAST workshop held in Brazil in 2019 brought together internationally prominent scholars, community-based practitioners, and agroecological producers who together have decades of experience supporting agroecological and agroforestry food production in the Americas through research, education, and advocacy. Participants included researchers from Canada, Mexico, Brazil, and Cuba, all of whom are co-authors on this paper, along with community members and farmers from Brazil and the NWT, Canada, and representatives of CSOs. Over the course of three days, participants visited Embrapa's Research Station in Caçador, Santa Catarina, to demonstrate and discuss current work on traditional knowledge that seeks to value agroforestry practices and develop sustainable, productive agroforestry systems that can be used to restore degraded areas. Visits were also made to three farms in which different versions of traditional agroforestry systems based on *erva-mate* have been maintained for generations. Discussions among community stakeholders and farmers were particularly important as they fostered the identification of common challenges being faced by agroecological farmers, while also highlighting opportunities for sharing knowledge across diverse ecological and cultural contexts. Further, the workshop offered a space to reflect on current research and outreach activities across the Americas, identifying areas for future research and engagement. Our goal was to further consolidate this international, transdisciplinary knowledge network into a regional alliance for agroecology and agroforestry capacity-building.

4. Results and Discussion

Since the 2019 event, each FEAST node has been developing a range of activities within their own countries and across the network, building on and integrating the lessons learned and take-aways from the collaborative research and outreach. Below, we provide a brief description of the development of each of the research-action nodes in the network and their current work. We then discuss some of the key themes that have been identified, interrogated, and addressed through ongoing dialogue, communication across the network, and further community-based research and engagement. We also consider some of the challenges that have arisen from the local research and outreach activities and global dialogues and events, including the true integration of local and Indigenous knowledges with academic research, the need for intergenerational knowledge exchange, and the constant awareness of positionality and translation of local perspectives inherent in multi-scale knowledge networks.

Despite the challenges to building a global agroecology network, all authors and participants agree that the experiences of coming together for the workshops and field schools have been exceptionally rich, with a shared sense of understanding across practitioners,

researchers, producers, students, cultures, and languages in relation to the challenges each of us face in our different contexts in working with agroecological production. There is also a deep sense of appreciation for the opportunity to share knowledge and experiences across these different contexts and a clear awareness of the importance of continuing to support traditional knowledge and sustainable productive practices. Our FEAST network is showing that effective communication and knowledge integration, sharing, and innovation across diverse regions are crucial elements in continuing and expanding the use of agroecological and conservation practices worldwide, offering a means to truly implement strategies for transformative change.

4.1. Brazil

The research network in Brazil focuses on traditional agroforestry practices on small-scale farms in Southern Brazil, which have been integral not only in supporting food security, but also the conservation of important forest and agrobiodiversity resources in the region. The key species of these traditional agroforestry systems is erva-mate (*Ilex paraguariensis*; called yerba mate in Spanish), which is a native tree species whose leaves are harvested in two- to three-year cycles for processing as a tea (*chimarrão* or mate). The systems generally occur in mature forests of the Araucaria Forest biome, with a canopy composed of large, long-living species such as *Araucaria angustifolia* (paraná-pine) and *Ocotea porosa* (imbuia), and a sub-stratum of erva-mate that takes advantage of its inherent characteristics as a shade-tolerant species. Small-scale farms that continue to employ these traditional systems tend to be diverse mosaics of forests, gardens, and crops, including corn, manioc, and rice, with animal husbandry. As such, they are important elements of food security at the local level, as many of these producers participate in the national Food in Schools and Food Acquisition programs (*Programa Nacional de Alimentação Escolar—PNAE*, and *Programa de Aquisição Alimentar—PAA*) that supply local schools and government institutions [55]. But they also maintain important agrobiodiverse landscapes, as they harbor significant plant and faunal diversity [56], and often preserve and plant heirloom or landrace seed varieties.

Research and outreach related to these traditional systems began almost 30 years ago, with outreach workers from Paraná's state agricultural research institution (*Instituto de Desenvolvimento Rural-Paraná—IDR-PR*) working alongside NGOs and other stakeholders to support the consolidation of these practices and practitioners in the face of pressure to "modernize" farming practices. Over the last 10 years, this network has grown to include both federal and state agencies, as well as farmer's unions and other interested parties, with several key research projects completed (i.e., [56–58]), and recent developments in knowledge dissemination, farmer-led research initiatives, and optimization [53,57]. Further, a Civil Society Organization (CSO), the Centre for Development and Education of Traditional Erva-mate Systems (CEDErva; cederva.org), was created to support the consolidation of information related to traditional systems, as well as advocate on behalf of practitioners of this systems, and a Strategic Council (*Observatório de Sistemas Tradicionais e Agroecológicos de Erva-mate do Paraná*) was instituted to encourage the continuation of these systems, bringing together new actors including the Office of the Federal Prosecutor of Labor in Paraná.

This transdisciplinary network brings together agronomists, forest engineers, anthropologists, historians, family farming union leaders, and farmers to address the many challenges small-scale producers are facing in terms of pressure to modernize, devaluation or lack of recognition of traditional knowledge and practices, conflict between traditional practices and current environmental and agricultural policies, lack of engagement of youth, and empowerment of women. One of the key developments that has come together since being involved in the FEAST network is the development of a proposal for traditional erva-mate systems to obtain recognition as a Globally Important Agricultural Heritage System (GIAHS) from the Food and Agricultural Organization of the UN. This FAO program recognizes agricultural systems that have had and continue to have important impacts on

agrobiodiversity conservation, food security, landscape, and the continuation of traditional knowledges and cultures related to food systems. Working together to build the candidacy has solidified the community of practice at the local scale and enabled the development of a long-term plan to implement actions that support the valuing and continuation of these socioenvironmental systems [59].

4.2. Cuba

With its longstanding reputation as a leader in agroecological research, innovation, and transformation, Cuba is well-positioned to contribute expertise to the FEAST network, and it does so primarily via two key partners: the Department of Sustainable Agroecosystem Management at the country's National Institute of Agricultural Sciences (or INCA, for its initials in Spanish) and the Agroecology Research Group of the University of Pinar del Río. The former has several longstanding research and education programs aimed at building capacity for sustainable agriculture, perhaps most notably the *Proyecto de Innovación Agropecuaria Local*, or Local Agricultural Innovation Project (PIAL). Born out of a participatory plant-breeding initiative in the early 2000s, PIAL grew to become active across Cuba and the highly participatory, transdisciplinary, multi-actor nature of its research-action activities (see [60]) exemplifies the FEAST approach.

In the case of Pinar del Río, the work adopts a holistic approach to agroecosystem research enabling analysis of interrelationships amongst crop, animal, and tree production. The research focus has much in common with the Brazilian node, as the Agroecology Research Group has significant expertise in agroforestry. Thus, the local work embodies a strong focus on the role that tree species—particularly native ones—can play in successful agroecological systems alongside the conservation of forest species. Like the Brazilian counterparts, efforts are also highly inter- and transdisciplinary, with significant collaboration amongst agronomists, ecologists, economists, sociologists, and psychologists, as well as farmers, policymakers, and other agricultural system stakeholders. In the case of both the University of Pinar del Río and INCA, educational programming also plays an important role, as the node emphasizes learning opportunities, particularly for graduate students, and supports farmer-to-farmer along with farmer–scientist learning and exchange as well.

4.3. Mexico

The Mexican node is housed at the Autonomous University of Chapingo, which is the country's leading agricultural research and educational institution. Specifically, work is centered within Chapingo's Interdisciplinary Research Center for Rural Development (CIIDRI), which is a well-recognized leader in agroecological transition processes and has also been a longstanding supporter of Mexico's movement for localized organic food networks [61]. The focus of action-research at the time of the 2019 workshop was on organic citrus production, and the work involved collaboration with small-scale producer organizations in the northern region of the state of Veracruz. Like the Brazilian and Cuban nodes, activities used a participatory action research methodology that favors the exchange of knowledge amongst different actors (producers, technicians, researchers, and decision-makers) and also emphasized the development of human resources—i.e., student training and education—at the University of Chapingo.

The majority of citrus production in Veracruz state is conventional, with significant application of pesticides (primarily glyphosate). This presents a series of threats to sustainability, fruit quality, and the health of fruit producers and consumers, as well as the inherent impacts on local biodiversity, particularly pollinators. In 2009, a group of scholars from Chapingo initiated transition towards agroecological citrus production in an orange grove located in Papantla, Veracruz. Since 2014, this “mother garden” has served as an “agroecological beacon” used to share sustainable technologies with small-scale, organized, cooperative producers in 10 municipalities across the state of Veracruz. The specific agroecological techniques and technologies used and shared include: compost; local rock powders; reproduction of locally derived, beneficial microorganisms; mineral broths (for

example, ash broth, sulphur-calcium mixture, border broth, etc.); legumes as cover crops; agro-homeopathy; pruning; diversification of cultivated species (e.g., addition of coconut, avocado, noni); promotion of broad-leaf weeds; and living hedgerows. The use of these techniques has led to a threefold increase in yield when compared to the regional and state average, with agroecological operations reaching more than 35 tons/hectare compared to the 14.5 ton/hectare conventional average. This translates into profits of 360% more than those of conventional producers who rely on agrochemicals, along with 22% lower production costs [62].

In 2021, with funding from Mexico's *Consejo Nacional de Ciencia y Tecnología* (CONACYT), Gómez and colleagues at the CIIDRI began to actively scale up activities related to agroecological transition in the region. Since then, more than 7000 producers have received training on the harmful impacts of glyphosate. Of those, close to 3000 (37% of whom are Indigenous) have chosen to participate in capacity-building for agroecological production techniques.

4.4. Northwest Territories

Work in Canada's NWT began in 2014 with an initial project between Wlilfrid Laurier University researchers and the Ka'a'gee Tu First Nation (KTFN) in the small community of Kakisa. This ongoing PAR relationship started with a project exploring climate change impacts on community well-being and food systems [63]. Food systems in northern Indigenous communities in Canada depend on harvesting traditional foods (e.g., fish, game, vegetation) from the land and waters. Hunting, gathering, and consumption of traditional food are foundations of physical and mental health for Indigenous populations in the region as they provide a connection to the land, the cultural benefits of sharing the harvest, and a nutritional food source [64]. Impacts to the land in response to climate change are having negative effects on the community's ability to ensure that traditional foods remain as the basis of their food systems; the KTFN are exploring opportunities to develop the local production of food, mainly through community gardens and greenhouses, to make food more available. Not only does local production provide fresh, healthy food to communities, but it also avoids the high cost of purchasing food from the store and the environmental impacts of transportation to remote communities and offers local economic opportunities. However, many important barriers exist that may limit the ability of Indigenous communities to realize the opportunities of growing food, specifically the lack of knowledge and capacity to grow food as agriculture is not a part of the traditional food system in Canada's North, as well as the ongoing impacts of colonization, including the legacy of residential schools and their association with gardens where many were forced to work [63–65].

For communities like Kakisa, ensuring that agriculture is developed in a way that meets the needs of residents in a way that is culturally appropriate and does not diminish the overall health of the ecosystem is crucial. Agroecology therefore offers a way forward and speaks to Dene cultural values of ecosystem protection and stewardship. The FEAST network, therefore, represents the opportunity to share knowledge and experiences with traditional knowledge holders and practitioners in other places around the world to help the community imagine the possibilities of agroecology as the way forward for local food production in the North.

4.5. Centering Research around Traditional Knowledge

One of the important take-aways from the FEAST network activities since 2015 has been the experience of seeing how centering research and outreach activities around traditional knowledge and community engagement can not only lead to important outcomes in terms of valuing traditional practices but also create strong ties of trust and mutual respect between researchers, farmers, and practitioners. A key challenge that researchers face in community-based and participatory research is the meaningful integration of conventional "scientific" knowledge and traditional and/or Indigenous knowledge systems, as it requires

innovative methods of doing research and an openness to valuing not only other ways of understanding agroecosystems and the environment but also the ways in which this information is shared. While academic research methods tend to focus on quantifying the impacts of agroecological systems in terms of, for example, ecosystem services, nutrient cycling, or soil and water dynamics [37,66], research and community engagement in each of the nodes indicates that farmers tend to emphasize socioenvironmental ties to the agroecosystem as expressed through memory, narrative, and affect [33,67]. As Gliessman [46] (p. 319) points out, “when farmers no longer have the incentive, desire, or ability to be good stewards of the land, ecological degradation is an inevitable outcome”. We would argue that fostering that incentive and desire does not come from graphs showing impacts on biodiversity or hydrological cycles but rather the affective ties that connect many small-scale farmers, agroecological producers, and Indigenous communities to their agroecosystems. All nodes of the FEAST network are implementing work that demonstrates the potential of narrative as a tool for change, bringing to the fore farmer and community member perceptions, narratives, and memories. The experience of developing the GIAHS candidacy by the Brazil node, for example, has clearly shown that the shared values as told through narrative and oral histories create community ties and a sense of belonging that supports the efforts of solidarity and working together that are essential to change dominant food systems paradigms. Thus, valuing both the knowledge and connection farmers have with the land, forest, and/or ecosystem fosters changes to the dynamics of research and extension and empowers farmers as researchers and knowledge keepers [38].

The intersection of different ways of knowing is integral to agroecological practice, but the “how to” often remains a roadblock to real engagement between communities, farmers, researchers, and other practitioners. Paying attention to how all the themes discussed during the workshops and meetings are entangled is a clear take-away. For example, in Brazil, the interdisciplinary nature of the academic representation—from agronomy to history to sociology to forestry—is especially noteworthy, as the team incorporates a wide range of disciplines and actors from different institutions, thus fostering transdisciplinary efforts. Perhaps more importantly is the willingness of researchers across a range of disciplines to work with these traditional systems, helping to develop an evidence base that highlights their role in providing a range of ecosystem services and socioenvironmental benefits. Building upon that idea, the integration of scientific knowledge and methods with traditional knowledge and practices as a means to support the continuation of traditional systems is an important theme of continued dialogue for the network.

4.6. Local–Global Communication through Practice

Including a range of international stakeholders in the network has brought about some interesting developments through new research and practical innovation based on what was shared and communicated about agroforestry and other agroecosystems in Brazil in the 2019 workshop and across the network. One of the most surprising developments was a shift in the way Chief Chicot thought about forests as a source of food and the possibilities of cultivating native species within their natural habitat. This discussion came out of the 2019 workshop in which the participants visited a range of agroforestry systems in which erva-mate is cultivated and harvested, along with a range of other medicinal plants, native fruits, and firewood. Seeing and experiencing the practice of managing the forest as an agroecosystem, led to changes in the way agriculture is discussed in Indigenous communities in northern Canada, shifting away from a colonial approach of implementing agricultural practices not developed in northern ecosystems to one that values traditional knowledge of native plants in boreal forests. As Johnston and Spring [65] (p. 11) point out, “Chief Chicot and the researchers recognized that the Brazilian practitioners’ knowledge about the intersection of food growing and forest management could be adapted to the NWT to help address the impact of climate change on the boreal forest, which is the basis of the traditional food system and an important global carbon sink”.

Thus, the sharing of specific practices and examples through the field schools and workshops have been highlighted by participants in the FEAST network as important learning experiences. For example, Gómez emphasizes that the participatory organic certification that was discussed as part of the farm visit to the faxinal in 2019 was particularly relevant for her, as it gave her examples and strategies as to how such certification systems can work on the ground and the importance of continuing to work toward participatory systems in agroecological production in Mexico and beyond. This recognition of the importance of sharing and communicating knowledge across what might seem divergent contexts has led to the development of another research project between the NWT, Brazil, and a new addition to the network in Migori County, Kenya. This project, Voicing Change, is focused on co-creating podcasts and radio programs that examine the local, innovative, and sustainable food systems in each of these regions to share stories and strategies to address common challenges and spark innovation within Indigenous and traditional communities in all three contexts.

While the use of digital communication is important as a knowledge-sharing tool [49], based on our experiences, the development of communication networks across local and global scales are significantly fostered by in-person and hands-on discussions. While often difficult due to language and logistics, on-site farm visits offer the chance to see and feel not only the agroecological and conservation practices in place but also how farmers and communities share and communicate information about these systems. These narratives are expressed through dialogue, and also through bodies and their interaction with the landscape, or geosymbolic landmarks [68], which are focal points that give meaning to the landscape, demonstrating affective relationships and memory [69]. Perhaps more importantly, participants experience and pay attention to the more-than-human actors that make up the landscape [8], through which we can perceive the entangled social, economic, cultural, and ecological histories that have shaped and shape the agroecosystem [70,71]. All of these experiences transcend barriers to communication and are centered in lived experience, creating possibilities to transform participants' perceptions and practices.

4.7. The Intersection of Agroecology and Conservation

The role of agroecology in forest and agrobiodiversity conservation has emerged as an increasingly important outcome and area of focus for the FEAST network. All nodes of the network are working with agroecosystems that are threatened due to the pressures of conventional agriculture and/or occur in regions with highly sensitive or particularly biodiverse ecosystems. The traditional agroforestry systems in Southern Brazil, for example, are key to maintaining forest cover in the region, a hotspot for biodiversity conservation, while the implementation of agroecological practices is an important strategy to protect the Boreal Forest in Canada's NWT in the face of a changing climate. Similarly, agroecological and organic practices in Cuba and Mexico are essential to protect the soil and water resources, create buffers to protect against increasingly devastating weather events, and support farmer autonomy in terms of reliance on expensive agrochemicals and conventional practices.

While many complex, intertwined factors contribute to global change, the industrial food system is having increasingly recognizable impacts, from its dependence on fossil fuels (for agrochemicals, machinery, and long-distance food transport) to deforestation for large-scale monoculture and animal grazing, leading to estimates that the sector is responsible for 31% of global greenhouse gas emissions [72]. At the same time, the biodiversity of agroecosystems is in rapid decline and precious soil and water resources are being contaminated and over-used. This leaves agroecosystems increasingly vulnerable to the impacts of a changing climate, including extreme weather events (e.g., floods, hurricanes) and less predictable precipitation and temperature patterns, in turn threatening food security and producer livelihoods. Agroecology is increasingly looked to as a framework for addressing these challenges as it enhances the social, ecological, and economic services provided by agricultural ecosystems, increasing biodiversity, enhancing ecological resilience

(e.g., soil improvements, wind protection), and creating income-generating opportunities, particularly for women and youth.

4.8. Challenges and Tensions Arising from the FEAST Network—From Positionality to Intergenerational Engagement and Markets

Disrupting the conventional paradigms of academic research requires critical reflection and a commitment to inverting the (colonial) power dynamics of knowledge in academia and beyond. Although all participants in the network are committed to such goals, the majority of the international participants in the FEAST workshop in 2019, for example, were academics, thus in some ways reinforcing this dynamic. This challenge has been a common theme of discussion among each of the nodes and across the network, particularly in terms of language, translation, and positionality (see [73,74]). For example, the Voicing Change project mentioned above draws on the experiences and knowledge of the communities of practice (CoP) at each location (Kenya, Brazil, and NWT). This information is brought to discussions and “translated” to the project-level CoP made up of researchers and students working in the three contexts. Meetings and discussions are conducted in English, as it is a shared language among the researchers. This results in several dilemmas and uneven power dynamics throughout the project. First, the local experiences must be translated by the researchers in terms of language, from the several languages spoken in Kenya and from Portuguese in Brazil, but they also require a reinterpretation or reframing by the researchers and students into language appropriate for the context. Further, language issues across the project create barriers to the wider participation of local actors who do not have the language capacity to participate, in some ways reinforcing the colonial power dynamics of academia. These challenges in creating a transformative international network persist and require constant reflection. As a means to address this challenge, ongoing collaborative research across the network has integrated resources for the language translation of project outcomes, such as lay publications and summary reports, as well as offering web resources with closed-captioning and automatic translation. The podcasts being developed as part of Voicing Change, for example, will all be available on YouTube, which provides free translation into subtitles between several languages. Furthermore, online meeting platforms, such as Google Meet, are now facilitated by automatic translation and transcription options. Although these tools are still rudimentary, they offer options to decrease some of the barriers to participation. Nevertheless, we are cognizant of creating nested scales of interaction and knowledge exchange that move across the different landscapes of the wider community of practice, each nested within the other, with iterative feedback loops, informing the whole.

That said, some distinction can be drawn between researchers from the Global North and South, with the scholars from Cuba, Mexico, and our more recent partners in Kenya, feeling their identities intersect both with their fellow academics but also with fellow Global South citizens. Additionally, during in-person workshops and field schools, a large number of local farmers and other stakeholders partook in the site visits and discussions, with a commitment by the organizers to prioritize the inclusion of young people, bringing fresh perspectives to the discussions. The outcomes of the workshops have made clear that future experiential meetings must include both academic and farmer international participants, as was the case with the participation of Chief Chicot in Brazil in 2019, to democratize the sharing of knowledge and experiences across our network and create space for innovative exchange around the principles of agroecology.

The need for intergenerational knowledge exchange and the involvement of women and youth in agroecological production is also an important theme that has been identified during the development of the network. During the visit to the faxinal community in São Mateus do Sul in 2019, for example, the entire family took part in discussing the traditional system and the challenges and successes they experience. Notably, the son of the property owners, Márcio, explained in detail his concerns about the future of the system and his commitment to continuing and improving on the traditional knowledge he has gained by working with his family and community. However, Márcio noted that he is an exception,

with many young people leaving farms to study or find work in urban areas, or choosing to adopt conventional agricultural practices as they are thought to be more profitable and “modern”. These concerns are echoed by Chief Chicot, Gómez, and García, who all agreed a key tension in the agroecological movement is how to combat the perception of “success” as yield or income, as opposed to producing sufficient ecologically and culturally relevant healthy food and an agrobiodiverse environment with clean air and water.

The FEAST network has discussed a range of strategies to engage youth and women in traditional and agroecological practices, but the issue of our current neoliberal economic system and the way it locks in conventional agricultural systems [1] weighs heavily on outlooks for the future. In the NWT, Chicot and Spring collaborate to host youth-focused on-the-land camps to facilitate bringing youth and Elders together to connect and share traditional knowledge and values of food sharing, connection to the land, and language. For young producers, understanding the need to work together and their role as agents of change is an important outcome that will have direct impacts on how they interact across their own local networks. Furthermore, the experience of being part of an international network reaffirms the importance of young peoples’ commitment to agroecological production as it highlights the global reach of agroecological practices and the possibility of participating in a global solidarity movement, thus offering hope for the future of these systems. For researchers, working with youth to ensure intergenerational knowledge sharing and the continuation of traditional and agroecological practices is a key aspect of the work that must be integrated in all aspects of research and outreach.

Another common tension identified during network events and dialogue was the dilemma many farmers face between accessing markets and/or corporate backers that value their products and maintaining the viability of small-scale diversified production. Again, the industrial food system and conventional markets loom large in these discussions. On the one hand, the expansion of interest in organic produce and markets is fueling growth in economic opportunities, while on the other farmers are aware that engaging in these conventional markets requires some trade-offs with the political underpinnings of the agroecology movement [75]. This tension is prescient for all participants across the FEAST network, from the citrus growers in Mexico, to fish harvesters in the NWT of Canada, and erva-mate producers in Brazil. By entering markets of scale, farmers and harvesters feel they must compromise on many of the key principles that they value in traditional and Indigenous food systems, including a focus on agrobiodiversity, connection with the land, and traditional ways of knowing and managing resources. Questions therefore remain as to how to create new ways of valuing these products and systems that ensure adherence to agroecological principles but also opportunities for economic return. The public market schemes in Brazil (i.e., PAA and PNAE described above) offer significant growth and innovation in this regard, as they create a supportive policy environment and offer an outlet for agroecological, organic, and small-scale family farming production. However, the political situation in Brazil since 2016 has underscored the need to think critically about farmers’ reliance on government programs for the long-term development and continuation of agroecological practices [56]. Because these programs are subject to political will, with the previous government drastically reducing budgets and viability, with many farmers reverting to conventional agricultural production, a focus on fostering farmer/community autonomy and food sovereignty is necessary.

Future meetings and activities of the FEAST network will consider all these challenges and outcomes, focusing on what agroecology means to the different actors in the network, including producers and harvesters, Indigenous and traditional communities, academics in the Global South and North, women, young people, and students.

5. Conclusions

The work of the FEAST network has made clear that although all participants face challenges that differ in tone and intensity, many of these challenges are common across the different contexts and the sharing of experiences is one of the most promising ways of

addressing them. Through the sharing and dissemination of this knowledge, agroecology will increasingly be strengthened and fostered, creating future opportunities and finding comparable examples to support advocacy. In particular, sharing case studies, stories, and narratives of progress and resistance, successful and unsuccessful experiences allows us to better understand success factors and overcome barriers. The exchange of students, shared training programs, and working with young people offer a means to promote the development of agroecological and conservation practices, value traditional and Indigenous knowledge, and support social innovation. Some of the young producers that participated in the workshop in 2019 discussed their role as communicators, disseminators, and supporters of agroecology at wider scales, principally by continuing their way of life and sustainable practices traditionally used on the farm and as advocates for the future.

While the focus of agroecology must remain local to ensure that practice and activism is relevant to the farmers and practitioners on the ground, there is a clear need to connect these local networks across a range of scales to build the solidarity necessary for the agroecological movement to take hold as an alternative to the conventional food system. However, creating effective knowledge networks on the global scale requires the commitment of facilitators who can move across scales, as well as the development of trust-based relationships in which members of local networks feel their stories are not just another case study but part of a wider conversation in which their voices and experience are valued [65]. The FEAST knowledge network is attempting to do just this, by bringing together researchers and practitioners with long-term, trust-based relationships and networks in the regions in which they work, to form a Community of Practice around agroecological production. In doing so, we are seeking to share experiences, knowledge, and opportunities across disparate regions as a means to explore how the principles of agroecology play out on the ground, and how local innovations based on these principles can create points of connection and solidarity across the network. The entanglement of lines of experience, affect, and ways of knowing are building the meshwork that forms the bridge between the local and the global, ensuring that communities are connected to and involved in a range of relevant discussions across scales.

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