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Towards Sustainable Agriculture: Alternative Movements and Iraqi Kurdistan's Agricultural Heritage

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***Abstract* — Critical global movements, particularly those led by Indigenous farming communities—as guardians and practitioners of our shared ancient agricultural heritage are spearheading alternative practices for clean and sustainable food production. These movements are shifting the focus of analysis from the Western-centric discourse of food security to the more inclusive concept of food sovereignty. Drawing on literature and empirical sources, this article examines the discourses and implications of industrial agricultural methods and the alternative movements that have emerged since the Second World War. Key concepts in both paradigms are explored to identify their justifications, strengths, and shortcomings. Emerging agrarian practices and knowledge systems of local and transnational movements and communities are described and enriched by a brief empirical study conducted in the Slemani Governorate of Iraqi Kurdistan. This article argues that the sustainable grassroots traditions of Indigenous communities worldwide, including those in the Kurdistan Region of Iraq, rooted in thousands of years of knowledge and experience, offer robust solutions and can contribute to the global and local debates on climate change and sustainable agriculture.**

***Keywords*—Sustainable agriculture, alternativ movements, Iraqi Kurdistan's agricultural heritage, climate change mitigation**

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I. INTRODUCTION

Currently, major institutions focusing on agriculture, including the main UN entities of the Food and Agriculture Organization (FAO), the International Fund for Agricultural Development (IFAD), and the World Food Programme (WFP), have joined forces with other international bodies in recognizing the immediate need for transforming the industrial model of agriculture into more sustainable systems (FAO, WFP, 2024; Quintero et al., 2024). Nevertheless, the central concerns of these major institutions remain focused on development policies and alleviating global poverty (i.e., food security). The economic argument within the UN discourse is prominent, emphasizing that food production must be increased to meet the growing needs of the world's population. (Janker et al., 2018). In turn, agricultural sustainability and the social well-being of small-scale farmers and their communities have remained secondary concerns within the mainstream discourse of elite bodies in the Global North. Janker and colleagues argue that although sustainable agriculture has been integrated into UN political discourses since the 2000s, it remains a "subordinate concept in the prevailing food security discourse" (Janker et al., 2018).

The objective of this article is to examine the trajectory of development in the discourses of agriculture since the 1950s and juxtapose it with post-1980s discourses and movements that advocate for sustainability and the protection of the planet's ecosystems. It also critically assesses both industrial and alternative agricultural models and calls for bottom-up, sustainable transformations that empower farming communities, recognize their resilient heritage, and enable collaboration with policymakers to develop sustainable solutions to the region's agricultural challenges. Departing from the prevailing industrial discourses that continue to tie global industrial food production to the paradigm of food security, population growth, and increase in food production and profit, this article shifts the focus of analysis to critical discourses and achievements of alternative movements that have mobilized globally over the past five decades. These movements advocate

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for sustainable, locally centered, small-scale agricultural practices rooted in Indigenous knowledge systems and ecological science that recognize the rights of all beings within the ecosystem while addressing the impacts of climate change on both rural and urban communities (Krebs and Bach, 2018; Gliessman, 2022; Legide, et al, 2024).

Against this backdrop, this article reviews and analyzes studies from around the world that have investigated the correlation between industrial and ecological practices and methods and illustrate their respective impacts on mitigating the effects of climate change (Dhillon and Moncur, 2023; Wynberg et al, 2023; Dorji et al., 2024). Key concepts and paradigms of industrial agriculture in the second half of the twentieth century are problematized and juxtaposed to alternative practices that have emerged since the 1980s. Additionally, this article builds upon the achievements of critical transnational movements that have made significant strides in ecological food production, empowering food producers and their communities. Moreover, it draws upon an ethnographic empirical study conducted in rural areas of the Kurdistan Region between 2023 and 2024 that builds on and highlights the potential of the region's local agricultural heritage as a sustainable solution rooted in thousands of years of knowledge for mitigating the effects of climate change (Abdullah, 2025).

II. MATERIALS AND METHODS

This article used a systematic review approach by searching credible databases such as Google Scholar, Web of Science, JSTOR, and Social Science Research Network to identify and screen the literature by using specified keywords such as sustainable agriculture, industrial agriculture, alternative agriculture, food sovereignty, food security, agriculture, climate mitigation, and Indigenous agriculture. Consequently, two hundred articles were screened, and thirty articles were selected for analysis based on relevance to the study's focus. Additionally, the ethnographic section of this study employs a combination of the qualitative methods of participant observation and structured/unstructured interviews, adhering to the ethical guidelines of the American Anthropological Association. The excerpts used in this article are part of a two-year in-depth fieldwork conducted in the Slemani Governorate between July 2023 and March 2025. A total of fifty farmers and practitioners were interviewed for the overall ethnographic research. Unstructured interviews were conducted after obtaining verbal consent from farmers and their families. After receiving consent from the interviewees, we conducted visual, audio, and /or video interviews to document their testimonies, practices, and traditions. We asked farmers about their past and present sustainable and industrial agricultural practices and traditions, as well as their struggles and mitigation strategies to climate issues. We engaged with the community through participatory exchange methods to share our agroecological knowledge and expertise as farmers and to discuss the importance of achieving food sovereignty. The excerpts of the interviews used in this article are from three regions in the Slemani Governorate: the Pishdar region in Hero district, Garmiyan region in Banimaqan, and Surdash region in Haladen Village. These regions highlight vital, sustainable Indigenous practices that ensured continuity and survival. The collected data were transcribed and thematically analyzed to enrich the study's findings.

Study Analysis

The State of Industrial Agriculture Today: Business as Usual?

An examination of the literature on industrial and alternative agriculture sources reveals that advocates and critics of the two groups are divided along distinct themes. However, since the outbreak of COVID-19, both industrial and ecological movements have sought to find common ground to mitigate the harmful effects of agrarian practices and, in turn, alleviate the severe impacts of climate change both locally and globally. In addition to calls for environmental protection, scientists and the public are increasingly concerned about food quality and its effects on human health. As Grauerholz and Owens explain, "As the risks associated with contemporary food systems intensify, we may see more cooperation and communication between the Global North and Global South around shared interests in safe foods" (Grauerholz and Owens, 2015).

It is evident that discourses from both industrial and alternative bodies currently working in agriculture agree that business as usual is no longer an option, and they call for direct and immediate transformations. In its 2018 report, *The Future of Food and Agriculture: Alternative Pathways to 2050*, FAO acknowledges that "business as usual" is no longer a viable option in agriculture. The report explains:

> "Business as usual is no longer an option" if the targets set by the 2030 Agenda for Sustainable Development, and specifically those directly concerning food and agriculture, are to be met. The high-input, resource-intensive farming systems that have caused massive deforestation, water scarcity, soil depletion, the loss of biodiversity, antimicrobial resistance of pests and diseases, and high levels of GHG emissions cannot guarantee the sustainability of food and agricultural systems. Moreover, a future of increasing inequalities, exacerbated climate change effects, uncontrolled migration, increasing conflicts, extreme poverty and undernourishment, as outlined in one of the scenarios of this study, is highly undesirable." (FAO, 2018).

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The report identifies a list of calamities facing the global industrial agriculture system, which are direct results of the introduction of the Green Revolution in the second half of the twentieth century in the Global North. To understand the aforementioned list of problems facing today's global farming systems (i.e., depletion of natural resources, widespread disease, inequalities, climate change, etc.), a brief critical analysis of the development of industrial agriculture is necessary. The Green Revolution, which began in the 1940s, transformed traditional agricultural practices worldwide into modern, industrialized agriculture. Under the pretext of eradicating world hunger, major institutions and organizations legitimized the transformation and "advancement" of agrarian practices and indigenous knowledge among small-scale farmers worldwide (FAO, 2018; Dorji, 2024; Mambo and Lhermie 2024).

Krebs and Bach illustrate that instead of eradicating world hunger and addressing disparities, the so-called advances of the Green Revolution resulted in the major environmental problems confronting humanity today, "based on the large-scale cultivation of monocultures using heavy machinery and a large number of agricultural chemicals, such as synthetic fertilizers and pesticides." (Krebs and Bach, 2018). While proponents of the Green Revolution insist that the advances in gene modifications, synthetic treatments, mechanization, crop yields, and food production have been significant (Chakwanda et al., 2024), critics argue that those advances are unsustainable and have come at heavy costs (Pielke and Linnér, 2019; Byaruhanga and Isgren, 2023).

Food Security as Justification?

In the aftermath of World War II, major international organizations, including the UN, the IMF, and the World Bank, along with their affiliated agencies, became central entities in shaping global socioeconomic and political agendas. Their discourses and policies gradually gained legitimacy and were implemented worldwide (Fomerand, 2023).

With the development of the Green Revolution, food security emerged as a central discourse in transnational circles and agrarian institutions, legitimizing the advancements proposed by the major institutions driving modernization policies. Following the World Food Summit's *Declaration on World Food Security* in Rome (1996), major organizations such as the World Bank and FAO adopted the Summits statement, that food security "exists when all people at all times have physical and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life" (FAO, 1996).

From its inception, the concept of food security was established to eliminate hunger and ensure that people everywhere have adequate access to food and resources. Therefore, this socio-economic discourse served as justification for implementing radical changes in ancient agricultural traditions and methods worldwide. From the mid-twentieth century, farming practices transitioned from primarily family-owned or small-scale farms that raised mixed crops and animals to larger industrial-style farms. Industrial farms produce one or more crops or animals in intensive, confined spaces owned by a few corporations rather than individual families (Grauerholz and Owens, 2015). Traditional farming practices came to be viewed as primitive and ineffective compared to the modern scientific advances promised by the Green Revolution. However, while the food security model aimed to increase food accessibility through modern scientific means, it overlooked the ancient ecological practices of farmers worldwide, as well as the environmental and health considerations for the planet and its living species (Byaruhanga and Isgren, 2023).

Additionally, critics argue that the food security model has favored major industrial institutions and food and chemical corporations, whose primary interest is profit. Janker and colleagues contend that the food security discourse fails to "show what 'socially sustainable conditions' should look like for the broader agricultural sector" (Janker et al., 2018). Furthermore, the 1996 FAO *World Food Summit* concluded that food security favors a market-oriented global trading system (FAO, 1996).

In line with the FAO report, the *Glasgow Food and Climate Declaration* (2021), states that the current concentrated industrial model of agriculture is the problem, not the solution. It emphasizes the need to transform the food system at all levels, from the soil on a farm to the food on the table (Gliessman, 2022). The report advocates for food systems that restore ecosystems and provide safe, healthy, accessible, affordable, culturally relevant, and sustainable diets for all. Similarly, the 26th United Nations (UN) Climate Change Conference of the Parties (COP26) and the Intergovernmental Panel on Climate Change (IPCC) have called for nature-based solutions to protect the planet's depleting resources (Wynberg et al., 2023).

In previous sections, some past and present challenges faced by the dominant global industrial agriculture sector were analyzed and highlighted. The dominant global industrial agricultural system was problematized through the critical examination of its discourses and its harmful impacts. In the following sections, alternative methods and practices are presented as potential solutions to the agrarian problems examined earlier. Some of these alternative solutions are rooted in the indigenous heritages of communities worldwide, including those in Kurdistan, and offer sustainable ways to mitigate the impacts of climate change.

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III. RESULTS

Indigenous Heritage: Documenting Oral Histories of Farming Communities in Slemani

This section presents an empirical ethnographic case study from Iraqi Kurdistan, emphasizing the region's agricultural heritage as a sustainable solution to the climate crisis. Mesopotamia is recognized as one of the five central regions in the world where agriculture first developed and was institutionalized. In modern-day Iraq and the Kurdistan Region, wild grain seeds of wheat and barley were initially cultivated and produced, and later shared with other parts of the world. Several archaeological sites in the Kurdistan Region of Iraq testify to this agrarian ancient heritage of the indigenous populations (Matthews et al., 2020). However, since the 2003 invasion of Iraq, the country's agricultural sector has been subject to mass imports of regional and transnational seeds, chemicals, and technologies (Sama and Jasim, 2024). Over the past two decades, the Kurdistan Region's agricultural sector has undergone industrialization, primarily relying on imported seeds and chemicals, as well as greenhouse agriculture. While a detailed analysis of post-1991 and 2003 agricultural changes in Iraqi Kurdistan lies beyond this article's scope, this section focuses instead on the enduring strength of Kurdistan's indigenous agricultural heritage and its potential for rebuilding a robust, clean, and sustainable agricultural system capable of nourishing local populations while mitigating the impacts of climate change. The following ethnographic excerpts are drawn from three farming communities in the Pishdar Region of Hero District, the Garmiyan Region of Banimaqan, and the Surdash Region of the Slemani Governorate

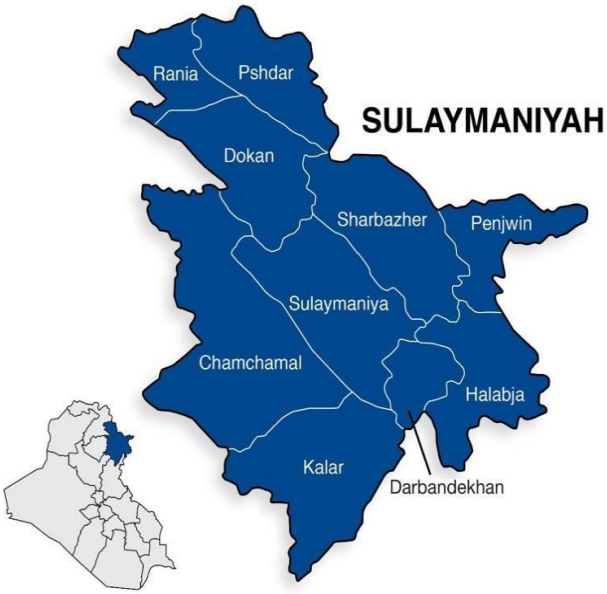

Figure 1: Map of Slemani Governorate, Iraq, durable solutions. Net

Since the summer of 2023, the joint research project, *The Oral History Study*, between the Kurdistan Institution for Strategic Studies and Scientific Research and the Rosa Luxemburg Foundation-Beirut Office, has been documenting the life histories of farming communities in the Slemani Governorate in Iraqi Kurdistan—focusing on the themes of food sovereignty and agroecological resilience. Its objective is to document and make accessible the neglected and understudied sustainable rich heritage of local peoples in the region, whose indigenous agricultural heritage and knowledge date back thousands of years in a region historically described as the backbone of Kurdistan and Iraq's food economy (Abdullah, 2025). Indigenous agricultural methods and traditions are at the core of all alternative ecological movements previously analyzed in this paper. Dorji and colleagues define Indigenous knowledge as the source of knowledge, traditions, and practices that have been established over generations among Indigenous communities with deep roots in their socio-cultural and ecological worldviews and relationship with the land. (Dorji et al., 2024).

For thousands of years, Indigenous peoples have utilized climate-resilient crop varieties, adjusted planting and harvesting cycles, employed crop rotation and intercropping, improved agricultural methods, and applied traditional storage techniques (Dorji et al., 2024). These practices have evolved over thousands of years of trial and error, enabling farming communities in the Kurdistan Region of Iraq to sustain their communities and pass down their indigenous knowledge from one generation to the next. In our *Oral History Study* in the Slemani Governorate, we have documented stories and traditions of farming communities in the Sharazur, Sharbazher, Surdash, Garmyan, Pishdar, and Bazyan regions, who, like farmers around the world, were once the guardians and protectors of sustainable ecological farming practices, seed, and crop varieties, whose heritage we can learn from and build upon.

In the district of Hero in the Pishdar Region, we documented stories of female potters who relied on specific soil types to produce a variety of clay vessels and containers for storing water, seeds, and preserving food. Made by hand from natural materials, these clay vessels protected locally produced materials and water from seasonal changes and calamities. Additionally, they were bartered with materials and food items unavailable in the local community and were sold in regional markets.

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Figure 2: Shirin's sustainable traditional clay pots are used to store goods from spoilage

While interviewing Shirin, a local craftswoman in Hero, we learned multiple stories about this sustainable circular economy. Shirin explained that in the past, these terra cotta vessels, produced in the village, were taken to the Garmyan region, where they were used to store water to cool and protect locals from heat-related illnesses in extreme conditions. In our 2025 film, *Lay Your Tired Hands on a Full Stomach*, Shirin elaborates,

> "Hero is famous for pottery making…They used the clay vessels for cooking and storing food. They made large clay pots for storing goods. They stored ghee and cooked meat. When they slaughtered a sheep or a goat, they stored their meat in the clay pots. It kept it fresh for a long time and did not change it at all." (Abdullah and Kareem, 2025).

This sustainable tradition, which had minimal effect on the local environment, enabled several communities to sustain themselves. The tradition continues today, albeit on a small scale, carried through by a few women in Hero. There are many more undocumented stories and traditions from the Pishdar Region, from which we can learn and build to overcome the upcoming climate and other challenges.

Legide and colleagues note that such Indigenous farming practices offer crucial lessons for mitigating climate change and restoring a sustainable food system. Some of these practices include intercropping, crop rotation, agroforestry, weather forecasting, soil and water conservation techniques, and water harvesting, as well as manuring and promoting environmental sustainability. (Legide, et al, 2024)

Similarly, Akinkuolie and colleagues argue that Indigenous Knowledge Systems are rich and diverse, having developed over many generations through direct interaction with local environments. Recognizing and integrating this knowledge into climate change mitigation efforts is therefore vital for promoting social justice, sustainability, and resilience. Indigenous communities have long adapted to changing environmental conditions and mitigated the effects of climate change, drawing on practices developed to protect their ecosystems and the services they provide. (Akinkuolie et al, 2024).

The ancestors of the local communities in the Kurdistan Region studied in this research were early practitioners of the world's agrarian heritage. Their enduring resilience and adaptive capacity have enabled them to survive and thrive through extreme conditions and uncertainties. In the Garmyan Region, in a village near Kirkuk, we documented the history of resilient grain varieties and legumes cultivated and preserved by local farmers for thousands of years. Using basic yet effective tools and methods —such as plowing with cattle, rain-fed irrigation, and the use of animal manure — these farmers maintained sustainable production systems. They created pools of liquid manure on the upper sides of the fields, channeling nitrogen-rich runoff through man-made irrigation canals to nourish the soil. This ancient practice of recycling organic materials enriched both soil and crops with minimal environmental impact—unlike modern-day synthetic fertilizers, which emit pollutants and degrade natural resources and food quality.

Additionally, the drought-tolerant and resilient heirloom grains and legume seeds, which have been preserved for thousands of years, have naturally adapted to drought and extreme weather. Relying on these ancient heirloom seeds should be a priority in contemporary agrarian policies to protect our communities' food sovereignty in the face of climate change, which severely affects our regions. Zenda and Rudolph (2024) similarly advocate for planting drought-tolerant crop varieties as an effective adaptation strategy, particularly in areas increasingly affected by water scarcity. Unlike modern hybrid and GMO seeds developed through experimentation in the latter half of the previous century, the ancient heirloom seed varieties improved by Indigenous farmers can tolerate weather changes while maintaining productivity with less rainfall.

Older farmers in several regions of our fieldwork spoke with great pride about the heirloom wheat and barley varieties that were the treasures of their local communities. They stored them in cool underground storage rooms to use for generations. Unfortunately, most of these treasured seed varieties were lost after the 1980s. However, there is still hope that, through our field search, we can find examples of these resilient seeds to plant and produce again. We can also rely on bringing back and growing samples of these ancient seeds stored in international seed banks to reproduce them and sustain our communities.

Dorji and colleagues emphasize the crucial role of Indigenous practices, such as reliance on resilient seeds and natural preservatives for storage methods and the construction

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of specialized storage facilities, in ensuring food sovereignty during climatic shocks (Dorji et al., 2024).

Finally, in the Surdash region, in the village of Haladen, we documented mountain farming techniques practiced by elderly farmers who utilize agroforestry, intercropping, and animal grazing to restore their ecosystems while producing plentiful food from their orchards and fields. We discovered that through these ancient practices, farmers in these mountainous areas have been able to overcome wars, extreme weather fluctuations such as early or late frosts, and economic hardships. Farmers in the region cultivate hardy wild tree varieties, shrubs, and seasonal cover crops, while protecting and nurturing wild plants and herbs gathered year-round to sustain their livelihoods. Rather than depleting their resources, they preserved them and used natural terraces to keep out domestic animals.

Farmers also manage pests and diseases by grazing animals in open fields and orchards during the autumn and winter. These seasonal food production cycles enabled the locals of Surdash and the surrounding mountain areas to maintain food sovereignty while supporting the exiled families and revolutionary groups during the late twentieth century. One key lesson we can learn from this community is the application of land restoration and afforestation methods, as well as sustainable farming practices, as vital strategies for mitigating climate change.

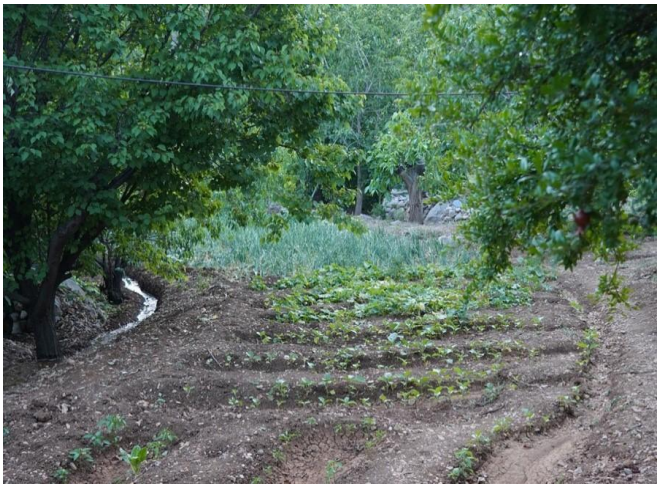

Figure 3: Sustainable agricultural practice in a field in Haladen Village, 2024

Akinkuolie and colleagues further note that Indigenous communities can significantly contribute to rural and urban forest restoration by utilizing traditional knowledge and customs. They argue that policymakers and practitioners should adapt strategies accordingly. They suggest that by learning from these traditional knowledge systems and engaging with Indigenous farmers, climate justice advocates, and stakeholders can develop solutions for social justice, sustainability, and resilience. By leveraging the knowledge and experience of Indigenous groups, stakeholders can effectively protect biodiversity, reduce greenhouse gas emissions, maintain cultural continuity, and ensure food sovereignty (Akinkuolie et al., 2024).

Our forthcoming study will provide additional examples of sustainable solutions for mitigating the impacts of climate change in the Kurdistan Region. These findings, which require further analysis and dissemination, will help expand our understanding of local ecological resilience in the years ahead.

IV. DISCUSSION

The Ecological Turn: Alternative Movements

This section provides a brief examination of the alternative shift in agriculture that has occurred worldwide since the 1970s, originating in response to the challenges posed by industrial agriculture. It identifies the movements, practices, and concepts representing this shift toward sustainable agriculture and their solutions for mitigating climate change. These alternative movements draw on ecological and sustainable traditions and methods rooted in both ancient human heritage and scientific principles.

Since the 1970s, critical movements have emerged in both the Global North and South, advocating for sustainable, just, inclusive, and holistic agricultural policies and practices that recognize the rights of all farming communities, ecological beings, and environmental resources. In opposition to capitalist and industrial farming systems, a global movement emerged in the 1970s, particularly in South and North America, that criticized the over-exploitation of natural resources and the poisoning of local communities' land and water, as well as the harm these practices caused to their members. This movement proposed alternative practices based on the heritage of farming communities and ecological scientific methods.

According to Mambo and Lhermie (2024), early participants in this movement adhered to three key pillars: cultivating chemical-free food, establishing an alternative distribution system, and challenging the prevailing food culture of the time. Consequently, demand for clean, ecologically grown food and farmers' markets surged in the US over a decade, leading to an increase in alternative food distribution systems such as co-ops, communes, and weekly farmers' markets to meet the public's needs for better food (Mambo and Lhermie, 2024). These community-supported agricultural initiatives resisted mass-produced industrial food. They demanded chemical-free food produced by small-scale farmers, with whom they could interact face-to-face and purchase directly at local markets. Grauerholz and Owens identify numerous alternative

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movements that have emerged in response to industrialized agriculture. These alternative movements including the local food movement, permaculture, agroecology, regenerative agriculture, and food justice, have gained visibility in food production circles due to their commitments to sustainability and social justice (Grauerholz and Owens, 2015). For instance, in the local food movement of the 1980s, local farmers' markets reemerged as a counter-market where consumers could find fresh, high-quality products while also feeling more connected to their communities by supporting local farmers and the local economy. These practices were also more sustainable as they minimized the energy and resources used by large industrial food producers to store and transport food across thousands of miles to retail stores (Grauerholz & Owens, 2015). Moreover, Lucas et al. (2024) note that farmers' markets, unlike industrial food markets, "enabled consumers to address social challenges by fostering connections, creating economic opportunities, promoting food knowledge, encouraging healthy eating habits, and providing venues for community events" in their local communities.

Alternative movements, such as La Via Campesina, which emerged in the early 1990s, now have millions of followers, many of whom are indigenous farming communities in North America, South America, and worldwide. This international movement organizes millions of peasants, indigenous peoples, migrant farmworkers, farmers, and rural women, among others, worldwide, who work under the ecological principle of food sovereignty (La Via Campesina, 2024).

La Via Campesina defines food sovereignty as the right of people to access healthy, culturally appropriate food produced through ecologically sound and sustainable methods, as well as the right to define their own food and agricultural systems. In their report on climate justice, La Via Campesina (2018) explains that while agribusiness has destroyed biodiversity, local ecosystems, the global climate, and livelihoods, peasant agroecology represents a critical pathway that sustains the world's populations without compromising the planet's health. The report emphasizes that diverse, peasant-driven agroecological modes of production, "grounded in centuries of experience and accumulated evidence, are crucial for ensuring healthy food for everyone while maintaining harmony with nature."

Agroecology has thus emerged as a central pillar of the ecological movement due to its holistic, interdisciplinary approach. Zenda and Rudolph (2024) argue that agroecology has been at the forefront of the ecological movement due to its holistic, interdisciplinary approach. Its strategies include "the use of Indigenous and drought-tolerant crop varieties, conservation agriculture practices, intercropping, agroforestry, and water management techniques. These strategies, in the long run, enhance crop resilience, improve soil fertility, increase water use efficiency, and boost overall farm productivity, thereby improving the livelihoods of smallholder crop farmers. (Zenda and Rudolph, 2024).

Agroecology is a key pillar of the alternative movement. It is now promoted in UN circles as a sustainable production method that can effectively mitigate the impacts of climate change. During its 2nd International Symposium on Agroecology, the FAO introduced the 10 elements of the agroecology framework as a groundbreaking pathway toward sustainable agricultural models. The elements, drawn from agroecological movements, include diversity, co-creation, knowledge sharing, interactions, efficiency, recycling, resilience, human and social values, culture, food traditions, responsible governance, and circular and solidarity economies (FAO, 2018). At the core of these elements is the necessity for sustainable agricultural models that respect and acknowledge the rights of all components of ecological systems, the rights of farming communities, and the production and distribution of healthy food.

Agroecological practices encompass recycling biomass, enhancing soil health, diversifying crop varieties and livestock, and minimizing water and nutrient loss on farms (Carolina et al., 2024). Two other movements that align with the ecological principles of agroecology are permaculture and regenerative agriculture. However, permaculture practitioners adhere to nature's patterns while ensuring sufficient food production. Krebs and Bach explain that permaculture aims to create resilient living systems inspired by the processes, structures, and patterns found in nature (Krebs and Bach, 2018). The principles of permaculture include observing and interacting, capturing and storing energy, obtaining a yield, applying self-regulation and accepting feedback, utilizing and valuing renewable resources and services, producing no waste, designing from patterns to details, integrating rather than segregating, employing small and slow solutions, valuing diversity, leveraging edges and appreciating the marginal, and creatively responding to change (Krebs and Bach, 2018). Each of these principles requires careful ecological planning, design, and the utilization of natural elements available in the local context, as well as the restoration and conservation of organic materials and natural resources. Furthermore, permaculture emphasizes the importance of respecting, preserving, and restoring natural elements, such as water, by working in harmony with nature rather than against it. Consequently, permaculture focuses on protecting habitats, species, and genetic diversity, cycling biomass and nutrients, enhancing the accumulation of fertile soil and water, and integrating various land-use elements to foster synergies (Reiff et al., 2024).

Along with agroecology and permaculture, the regenerative agriculture movement has achieved significant success over the past two decades, and its followers and practitioners are growing in strength worldwide. Regenerative agriculture, like

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its sister movements, is based on ecological and indigenous elements, includes minimal soil disturbance, maximizing crop diversity, keeping the soil covered, maintaining living roots, and building soil enrichment and carbon sequestration, i.e., keeping carbon and its sister elements in the ground to enrich the soil and the ecosystem (Mambo and Lhermie, 2024). In addition, in regenerative agriculture, practitioners work on the objectives of minimizing soil disturbance, keeping the soil covered year-round, keeping live plants, keeping roots in the soil for as long as possible, incorporating biodiversity, and integrating animals to mitigate the impacts of climate change and industrial agriculture, such as the elimination of pesticides, and the use of unnatural elements. Like agroecology and permaculture, regenerative agriculture also requires continuous hands-on work in the field and meticulous planning procedures, such as planned grazing, limited tillage, land planning, and financial and ecological monitoring. (Mambo and Lhermie, 2024).

All of the movements mentioned above demand radical shifts in agriculture to restore local ecosystems, the quality of food produced, and the rights of local and transnational indigenous communities and farmers. As Janker et al. (2018) argue, sustainability discourse and policymaking must include human and social dimensions—placing people at the center of sustainability definitions and assessments.

The alternative movements work under the alternative principles of food sovereignty, which “values food cultivation as a means of maintaining sustainable ecosystems and promoting cultural integrity as opposed to a means of maximizing and accumulating capital, resources and property” (Kamal et al., 2015).

Unlike the neoliberal food security model, food sovereignty demands complete sovereignty for farmers and their communities' overall agricultural rights, from production to distribution and marketing, free from monopolization of local and international companies. Silva and colleagues illustrate, the primary emphasis of food sovereignty is on the sustainable production of food by small-scale farmers, local producers, and local communities, rather than on imported food and the international trade system (Silva et al., 2024). As Byaruhanga and Isgren (2023) emphasize, food sovereignty recognizes people’s right to determine their own agricultural systems and to access nutritious food produced according to ecological principles.

Consequently, food sovereignty recognizes people’s right to determine their own food and agricultural systems and to have access to healthy, nutritionally rich food produced in accordance with ecological principles (Byaruhanga and Isgren, 2023). The emerging movements, which have been growing strongly since the 1970s, have shifted the focus of analysis of the food production political discourse and the growth and spread of strong alternative agrarian movements and practices in both the Global North and South.

In the final section of this paper, I present an original case study from the city of Slemani in Iraqi Kurdistan, where, since 2023, preliminary work has begun on producing ecologically grown food at the Kurdistan Institution's research garden, as well as conducting ethnographic research and implementing informative measures to promote sustainable agriculture.

CONCLUSION

Through examining discourses, practices, and impacts of industrial and agricultural methods, as well as the alternative movements that have emerged since World War II, this article has highlighted the key concepts, justifications, strengths, and limitations within both paradigms. It has also explored traditional and emerging agrarian practices and knowledge systems of local and transnational communities, emphasizing their contributions to sustainability and climate resilience. These discussions have been enriched by empirical examples from an original ethnographic study conducted in the Slemani Governorate of Iraqi Kurdistan.

Adopting sustainable agricultural methods enables practitioners and policymakers to collaborate effectively in mitigating the effects of climate change. More focused studies are needed on the heritage and sustainable contributions of small-scale farmers, both globally and locally, to explore the counter-strategies employed by local communities and their impacts. Policymakers in Iraq and Kurdistan must prioritize adopting sustainable farming practices while recognizing and supporting local farming communities to revive the country's ecological food production system. Working towards stronger collaboration among policymakers, researchers, practitioners, and farmers to develop context-specific strategies and allocating needed resources to reintroduce sustainable practices that protect natural resources, cultural heritage, and food systems. This can be initiated by recognizing the vital role of small farmers in the socio-economic development and political stability of rural areas as the main producers of critical goods that help maintain food sovereignty, nutrition, and public health. This article lays the groundwork for more comprehensive research in the region. Future researchers are encouraged to delve deeper into the current agricultural systems of the Kurdistan Region, focusing on their impacts on rural livelihoods, environmental sustainability, and food quality. Such emerging studies will be vital in closing existing gaps and advancing our understanding of sustainable agricultural development in the region.

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CONFLICTS OF INTEREST

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