

Article

Integrating Food Culture with Socio-Environmental Recovery: Case Study Perspectives from the Global South

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Abstract: This paper discusses how local-level food systems, social remediation and environmental restoration can be linked to increase stability and build resilience inside extremely vulnerable communities. Specifically, it details how food culture entwines with socio-environmental restoration to benefit three low-income urban and peri-urban communities located in Thailand, India and Brazil. It aims to add to an existing body of knowledge that resides at the nexus of food, socio-environmental restoration and informality. It details effective, proven initiatives that have been regionally replicated to support marginalized communities to better cope with the negative effects of simultaneous stressors. It posits that imaginative visioning can be applied to simultaneously cultivate food security, remediate neglected lands and improve socio-economic opportunity. It provides a contribution to the field of social-ecological restoration planning in relation to food studies in lowest-income contexts.

Keywords: foodways; socio-environmental recovery; circularity; resilience; sense of place

1. Introduction

1.1. The Study in Context

The places where society's informal and lowest-income earners reside are rarely perceived as holding much worth. Their voices are seldom heard, the services they provide are undervalued and their legacies are all but invisible. This study is based on the premise that these places can often hold significant socio-ecological heritage value (Otero et al. 2013) and posits that both intangible and tangible forms of heritage, in the broadest sense—that which is or may be inherited—can be positively embedded in these places through locally-based food systems (Rekow 2014). These foodways are defined by multi-directional flows between locally based producers and distribution chains, the land that supports them and the culture that surrounds them.

Through three case studies—located in Amphawa (Thailand), Kolkata (India) and Rio de Janeiro (Brazil)—this paper examines how creative involvement with food interlinks with restorative, socio-environmental practices to constructively reshape land use, tackle social exclusion and mitigate environmental degradation in areas suffering from neglect. As integrated suites of sustainability practices, they connect social and biophysical subsystems to influence human quality of life and regional security (Zurlini and Müller 2008; Reed et al. 2017). They also illustrate the limitations and justice challenges (Lombard and Rakodi 2016) experienced by numerous poor communities¹ (Tornaghi 2017) in the Global South.

¹ For the purposes of this paper, a “community” refers to a group of people living in a specific geographical location at similar socio-economic level.

1.2. Purpose and Significance

This paper is an exploratory study that uses inductive research to investigate how local-level foodways entwine with social and environmental restoration initiatives to impact lowest-income sectors in the Global South. It aims to broaden an existing body of applied, humanistic research at the nexus of food, resource recovery and informality and may be of particular interest to interdisciplinary sustainability practitioners working in the fields of urban planning, food security, socio-environmental restoration and human security. It highlights context-specific understandings of foodways and how they interweave with wider sustainability efforts to benefit people living in poverty. It demonstrates how food systems can be harnessed by various agentic coalitions to focus cooperative actions, enact pro-poor policies, restore degraded environments and build local-scale stability. The cases discussed collectively offer a way to envisage the vital role that local food culture plays in sustaining marginalized urban and peri-urban communities. This is valuable for gaining further insight into the ways in which post-growth co-productions function on the societal fringe in the 21st century.

1.3. Literature Review

Re-traditionalization and re-localization are parts of a suite of post-growth, post-development strategies (Roman-Alcalá 2017; Trauger 2014; Akbulut et al. 2019; Escobar 2015) that rearticulate relationships between social dynamics and food culture (Šūmane et al. 2018; Sobal 1999) and redefine *place value* measures in relation to economic, social, environmental and health outcomes (Béné et al. 2019; Galal et al. 2010; Carmona 2019; Cernev and Fenner 2020; Leach et al. 2020; Moffatt and Kohler 2008).

As recovery concepts, they satellite around municipal-scale social-ecological restoration initiatives as applied practices (Fernández-Manjarrés et al. 2018) that have a limited, yet impactful capacity to respond to inequities and rights disparities in informal and lowest-income sectors (Miraftab 2009). In this context, insights gleaned from insurgent planning strategies (Miraftab 2009) and distributive justice (Roy 2005) are useful in understanding how restorative coproductions (Heller 2012; Watson 2014) can enhance dynamic interplays between informal and formal agencies to foster resilience in marginalized communities over the long-term (Revi et al. 2014; Cook et al. 2014; Cleveland 2013; OECD 2008).

These efforts require policy prudence and institutional support that look toward enacting participatory development strategies that endorse equity in land use, citizenry rights, local tenurial security and conservation protections—challenges that are all fundamentally political in nature (ILO 2018; Ferguson and Navarrete 2003; Imperato and Ruster 2003; Smith 1973; Arnstein 1969; Schanbacher 2010; Saleh and Rahaman 2014; Kimani-Murage et al. 2014; Leach et al. 2020).

The multi-dimensional phenomena, relations and feedback loops that shape the underlying socio-nature of food are not generally considered in economic, legal or behavioral terms until they are threatened (Buttimer 2015)—for example, in the crisis conditions that led to the Arab Spring (Rosenberg 2011). Consequently, there is emerging interest in the governance components of linked social-ecological systems (Visseren-Hamakers 2015; Throsby 1995; Danilo 2018) as they relate to food security in low income sectors (ILO 2018; Danse et al. 2020; Ansah et al. 2019). There is also ongoing interdisciplinary interest in identifying how foodways are an important feature of salient structures that link social, ecological, economic, health and cultural systems in crisis recovery (United Nations 2008; Revi et al. 2014; Morell-Hart 2012; Revi et al. 2014; Galal et al. 2010; Weiler et al. 2015; United Nations Department of Economic and Social Affairs 2019).

Designing circular restoration activities around concepts of waste and recovery (Lehmann 2011; Zucchella and Previtali 2019; Millington and Lawhon 2019) through a sustainable food systems approach (United Nations FAO 2018) requires acknowledging issues of health, justice, identity and democratization (Cachelin et al. 2019; Ellen MacArthur Foundation 2019), in addition to those associated with *accumulation by dispossession* (Mahmud 2011; Samson 2015; Rekow 2016b).

Regenerative approaches to restoring foodways through resource recovery activities offer a way forward for reconsidering how degraded lands and water bodies can be sustainably utilized (Smit and Nasr 1992; Zazo-Moratalla et al. 2019). Just as pertinent to this discussion are narratives that explore

food at the nexus of identity, Indigeneity, Traditional Ecological Knowledge and ethnobotanical science (Salmón 2012; Wall Kimmerer 2014).

Sense of place studies, especially in socio-spatial contexts that can be examined as *living labs*, remain under-examined in sustainability transitions literature (Kibler et al. 2018a; Frantzeskaki et al. 2018). Despite a wealth of information, there remains relatively few integrative scholarly discussions that examine how social-environmental restoration in marginalized communities (Leach et al. 2018) might be positively bound up in cultures of food (Kittler et al. 2016). As Dr. Francesca Muccini writes for another *Humanities* special issue on food, “Food features in our daily lives in innumerable ways” (Muccini 2016). Thus, broadening humanistic understandings of how food can act as a structural device to reinforce broader recovery activities can open up fresh insights into sustainability studies and moreover, point to how lowest-income communities might be strengthened (Roman-Alcalá 2017).

1.4. Aims

This paper aims to enhance an integrative understanding of how local level foodways bind with social, economic, environmental and cultural restoration processes by exploring cases where food serves as a fundamental part of a collective lived recovery experience. It attempts to foreground how food can be embedded in resilience initiatives to restore physical space, alleviate poverty and establish positive community identity. This perspective emphasizes that striving to realize humanistic qualities of sustainability, such as self-actualization and a positive attachment to place, improve people’s ability to increase their potential well-being in crisis and post-crisis situations. The three case studies described below offer a starting point for reconsidering how locally based food systems are vital components of larger restoration and recovery initiatives that point the way to building social protections over time at a regional scale.

2. Methods

Using a blended case study approach (Mackinnon 2013) based on inductive reasoning, this paper analyses three cases that engage with food as a central component for socio-environmental restoration. Each initiative has been operational for longer than a ten-year period and each represents a range of recognized good practices (Bleijenbergh 2010; Elger 2010).

Primary source research was based on site-based fieldwork and semi-structured stakeholder interviews (Olsen 2010) that were synthesized to form the core of the case study reports. This information was triangulated with secondary sources and interpreted (Denzin and Lincoln 2018) to appraise multiple dimensions of cultural (de la Torre 2002) and socio-ecological recovery (Low 1981; Fischer et al. 2015; Folke et al. 2016), specifically as it relates to the conservation social sciences (Bennett et al. 2017), see Figure 1.

In the case of Amphawa and Kolkata, field studies were initially conducted over a series of two-month periods between 2003 and 2005, with follow-up research being conducted in 2010 and again in 2015. In the case of Rio de Janeiro, ongoing fieldwork took place between 2010 and 2016, with research continuing through 2020.

Amphawa interviewees included community leader Krit Methawee, Director of the Amphawa Chaipattananurak Association and eight local vendors (two male vendors from Bangkok, two male street vendors, four local female boat vendors) at the larger of the two markets; and one community leader, four local male vendors (two agricultural, two street) and four female boat vendors at the smaller Tha Kha market, conducted on site in April 2015.

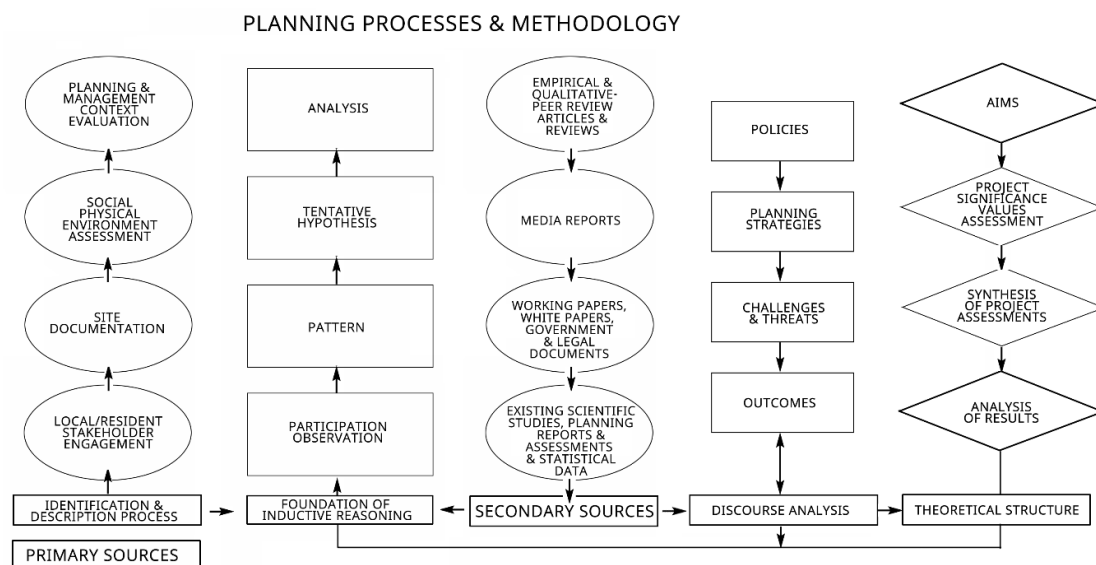


Figure 1. *Planning Processes and Methodology* schema by Lea Rekow, 2018–19 (CC-BY-2.0). Also see attached Supplementary Materials.

Kolkata interviewees included ecologist Dhrubajyoti Ghosh; Ganesh Bag, fisherman, secretary of Mudially Fishermen Co-operative Society (MFCS) and Mr Mukut Roy Chowdhury, CEO of MFCS and former government nominee from the fisheries department, conducted on site in March 2015.

Rio De Janeiro interviewees included Julio César L. Monteiro de Barros, Director of Hortas Cariocas (a program of Rio de Janeiro’s Municipal Secretary for the Environment), six Manguinhos gardeners (male), two pre-teen children (female and male) and one Brazilian garden volunteer (female) conducted on site from June 2014 through July 2016.

Interviews were conducted in native languages and translated into English via several multilingual translators. Some respondent names have been withheld by request.

Limitations

By necessity, much information has been omitted or simplified in these case study analyses. Some cases are understood by the author in more detail because of different levels of involvement with each case. Furthermore, the complexities within and across studies are difficult to represent simply. Only a relatively small number of community leaders and stakeholders provide key interviews analyzed for the purposes of this paper. Even as the author has a working familiarity with each site and various degrees of interactions with each community over time, these case studies must be acknowledged as representations assembled by an outsider with limited access to understanding the very different sorts of experiences that play out in everyday life for the people living in these communities. Therefore, the information put forth about each case study is dependent on the insights gleaned as important by the author, even though effort has been made to present adequate evidence from secondary data to support the information assembled from place-based research.

3. Description and Individual Analysis of Case Studies

3.1. Overview of Cases

The first study—the “floating markets” (not to be confused with “wet markets”) located in Amphawa, Thailand—links the revitalization of traditional architecture to the revival of waterfront food markets. It examines the peri-urban region of Amphawa, nestled in the farmlands of Samut Songkhram province, approximately 90km outside of Bangkok. It discusses the similarities and differences of both the larger (more touristic) Amphawa market and the smaller (more rural) Tha Kha

market, both located within ten kilometers of each other. Once dilapidated towns, waterfront street stalls and market boats piled high with produce and seafood now line the riverbanks and sell a variety of locally prepared meals and desserts.

The second study—located in the Eastern Wetlands of Kolkata, India—outlines how solid and liquid waste generated by the city is sustainably treated and reutilized to support the city with a supply of fresh vegetables and fish. Specifically, it examines one collective in depth, the *Mudially Fishermen's Cooperative Society*, one of the many traditional pisciculture collectives that provide crucial resource recovery services for Kolkata and a means of livelihood for a number of urban poor, despite ongoing threats from industry and development.

The third study—located in Rio de Janeiro, Brazil—explores the activities of the *Hortas Cariocas* program, a municipality-led agroecology project which has established organic urban food gardens in approximately forty underserved and informal communities (favelas/slums) and numerous schools throughout the city. These are innovative public investments that work with local Residents' Associations, municipal schools and individual participants to remediate degraded lands, make food gardens, create productive green space, build food and nutrition security and fight persistent poverty.

Each of these cases demonstrate how the culture of food (practices, attitudes and networks surrounding production, distribution and consumption) are vitally embedded in processes that invigorate collective action, cultivate positive relationships between people and their environment and help tackle wider systemic problems that typically overburden the poor.

3.1.1. Case Study: Amphawa, Thailand

Description

Floating markets (in Thai “ตลาดน้ำ”) refer to waterside markets, even where no boats are used in commercial sale or trade. Contrary to the Western concept, where boats are considered the main component, floating markets consist of rows of canal-facing shop fronts which interface with boats carrying fresh produce or serving freshly prepared meals, see Figure 2. On the back end, these waterfront market houses allow for land-based agricultural supplies to be delivered from nearby food-producing orchards. Some of the houses also serve as family residences and restaurants, or places of cultural or artistic expression (Rivera and Ackaradejruangsri 2017).



Figure 2. Amphawa floating market by Mayumi Ishikawa 2013 (left) and Moody Man 2017 (middle) (CC BY-SA 2.0) and Tha Kha floating market by 快 2018 (right) (CC BY-NC-ND 2.0).

The markets form a network of traditional waterfront trading communities originally established in the mid-17th century, which connect via 330 canals that crisscross Thailand's central countryside. Until the latter part of the 20th century, merchants traversed hundreds of miles of these interconnected waterways to transport food and other goods around from province to province. Every waterfront community had a public wharf (a dockside floating market) where vibrant forms of public life—especially the buying and selling of food—took place.

Historically, residents of Thailand's central region traded food, agricultural harvests and other products on the rivers and canals through a system known as “ตลาดนัด” (market on appointment). Different markets were active in different places on different days, on dates determined by the lunar

calendar (appointments), during which times vendors gathered to trade. People traveled from different provinces to markets located on larger canals connected by main rivers (“big appointment”), while markets situated along smaller canals were more commonly frequented by people from nearby communities (“small appointment”) (Pongajarn et al. 2018). The markets were not only essential for trading food, they were also important as social gathering places.

Amphawa is little more than an hour and a quarter’s drive from Bangkok. Formerly, this small riparian community played a central role in Thailand’s network of agriculture-based trade along the Mae Klong River Basin. The decline of its market (once the communications center of the province), along with other water-based trading communities in the region, is attributable to the development of road networks from the 1970s on (Silapacharanan 2013). With the mode of transport and thus the distribution routes for regional produce radically altered, Amphawa’s floating markets came to functionally close.

The area’s numerous orchards, which had produced onions, garlic, chilies, limes, coconuts, mangoes, lychees, coconuts and apples in abundance, fell into disrepair. Expressions of traditional art and architecture were replaced with concrete buildings, roads and housing estates as the region transformed over time into a string of land-based settlements. Waterways became polluted and floating markets gradually all but disappeared (Amphawa-Chaippatananurak Conservation Project, and Chaipattana Foundation n.d.). Many farms and homes were left vacant as residents migrated to larger urban centers to find work. By the late 20th century, the region’s once vibrant canal-centric way of public life had been almost completely abandoned. Only a few vegetable sellers and one meat vendor remained in the area (Cohen 2016; Vajirakachorn and Nepal 2014). Even so, Amphawa managed to retain a large part of its cultural identity due to its alluring traditional architecture of pile dwellings set along the banks of the Mae Klong River.

The revitalization of floating markets began early in the 21st century. Economic recovery strategies were deliberately crafted to forge links between cultural heritage and gastronomic tourism to capitalize on a growing desire for tourists to experience a more traditional way of life (Vajirakachorn and Nepal 2014; Silapacharanan 2008a).

The floating market revitalization plan ties into a larger project focused on environmental conservation of rivers and canals. A series of participatory projects undertaken by public and private agencies—including municipal government, universities, companies, NGOs, local stakeholders, the Chaipattana Foundation and the Danish International Development Assistance—developed from 2001 onward, have restored traditional waterfront architecture and promoted activities to encourage gastronomic tourism, showcase cultural heritage and re-stimulate market culture (Silapacharanan and Dupuy 2011; Peerapun 2012; Peerapun et al. 2006). Traditional culinary resources and food-growing methods were used as unifying strategies to encourage self-reliance, bring a sense of pride back to the community and reinvigorate a languishing local economy (Lunchaprasith 2017). Participatory planning meetings, led by the mayor, resulted in a municipal-level organizational structure to register and manage vendors. Incentives were initially offered to attract vendors, as before the market reopened, they could not make minimum wage from selling traditional foods. Within months, however, they proved unnecessary as revitalization led to economic profitability (Vajirakachorn and Nepal 2014).

More than 80 percent of people living along the Mae Klong River are farmers (Lunchaprasith 2017). Fruits and vegetables grow in orchards and coconut groves, while brackish-water seafood (particularly mackerel and krill) are farmed along the river mouth, see Figure 3. At the Amphawa market, shopfronts and food stalls selling traditional foods and confectionary run along the canal and stretch out into the surrounding streets. Canals are occupied by boat merchants who sell local produce and freshly prepared foods (seafood, noodles, coffee, desserts). A local orchard serves as a center for knowledge sharing between traditional agricultural practitioners and others (Rivera and Ackaradejruangsri 2017). Condiments, spices, fermented pastes and coconut sugars form the base of traditionally prepared curries, made from family recipes passed down over generations. Beautifully hand-crafted sweets are packaged in clay pots fired in a local kiln. A coffee house serves pastries made at a 4th generation

Chinese patisserie. It is recognized as a site of community heritage. Visitors can take part in cooking experiences and a Thai dessert museum exhibits a variety of sweets available from on-site food vendors. These interconnections between restoration of traditional architecture, environmental conservation, food culture and community development, tie to a sense of place through multiple forms of tangible and intangible cultural heritage and identity (Silapacharanan 2008b; Lunchaprasith 2017).



Figure 3. Map of Amphawa and Tha Kha in relation to Bangkok by Lea Rekow 2015 (CC-BY-2.0) 2015; coastal prawn farms and salt works spread out from the mouth of the Mae Klong River in Samut Songkhram Province (right) by Paul_012 (CC BY-SA 3.0).

The smaller Tha Kha floating market, located ten kilometers inland from Amphawa, also underwent a process of decline and revival. In the early 2000s, local authorities began restoring canal-front infrastructure to prevent further deterioration and encourage tourism. Consequently, the market avoided closure and is only one in seven throughout the country that has continuously remained open over time (Cohen 2016). Tha Kha is a small market with between fifteen and thirty boats that sell agricultural produce and traditional foods, mostly to local residents. A restaurant and a few shops sit along the riverbank and perpendicular to the canal. The operating hours of this market have, until recently, followed the Thai lunar calendar, opening early in the morning and closing at around noon on weekdays, indicating it operates for locals rather than for tourists. The market now also opens on weekends, though tourists remain few. A strong sense of social cohesion indicates the possibility for long-term success, though this depends largely on retaining each consecutive generation's interest in waterfront trading (Charoensombat 2002).

The Tha Kha and Amphawa markets, along with several others in close proximity, have reemerged as focal points of the region, once again reflecting a canal-centric way of life. As a result, respondents say they are more aware of regional identity and the value of cultural heritage. Residents who were once forced to leave their community have returned to find work and start businesses (Wiriyaipinit et al. 2011). Now, second-generation restoration projects include cultural heritage conservation, improvements to infrastructure, landscape restoration and environmental monitoring (Utarasakul et al. 2014). In 2008, the revitalization of the central Amphawa market earned the town an “honorable mention” in the UNESCO Asia-Pacific Awards for Cultural Conservation (UNESCO 2008).

Challenges

By design and from the beginning, Amphawa's revitalization rested on elevating its cultural assets for the purposes of attracting tourism. Despite many benefits, this also poses major threats. Though the smaller Tha Kha market serves as a model for community-based revitalization, the larger Amphawa market relies heavily on tourism, operating during inverted hours on weekend and holiday afternoons and evenings to attract approximately 400,000 domestic and international tourists annually in 2009 (Rivera and Ackaradejruangsri 2017). As tourism increases, so do conflicts over space, competition

between tourism operators, spikes in food and rent prices and arguments between stakeholders. Outside interests are converting canal-side dwellings into resorts, homestays, stores, restaurants and coffee-shops at an alarming rate (Vajirakachorn and Nepal 2014). As change in land use gathers momentum, a rise in land prices are resulting in a loss of agricultural land, escalating urban density and spawning the construction of multi-story hotel structures owned by outside corporate entrepreneurs (Cohen 2014). A lack of municipal regulations fails to address forced evictions, displacement due to outside interests, land ownership consolidation and wealth inequity. Rents have quadrupled and all of the waterfront houses are now owned by ten families, mostly who come from and live in Bangkok (Vajirakachorn and Nepal 2014; Wiriyapinit et al. 2011).

The growing number of tourists, more than 10,000 a day on weekends in 2010, has catalyzed increasingly disastrous environmental stresses including overcrowding, transport congestion and excessive fumes from vehicle exhausts (Cohen 2016). More than 300 firefly-spotting boat excursions choke canals in the evenings, jeopardizing the firefly population itself, as some homeowners so frustrated by the numerous motorboats have cut down their Lamphu trees where the fireflies gather (Cohen 2009, 2016).

Economic overdependence on the tourism industry, stakeholder inequities in planning and development decision-making powers, a narrow contact zone between tourists and locals and the complex social and environmental trade-offs associated with tourism in general, have exasperated community dissatisfaction. General attendance at community meetings has dwindled and civic participation in ongoing planning has decreased. Though more than half the original attendees at meetings remain committed to the process, the ultimate decision-making power still rests with the mayor, leaving many residents feeling disempowered as local interests lose control over development processes (Vajirakachorn and Nepal 2014).

With the larger market having now reached saturation from tourists, it is in danger of losing its allure as a 'genuine' experience. This creates a potential threat that may devour the smaller Tha Kha market as tourists expand their search for a new and 'authentic' floating market experience. Floating markets are increasingly vulnerable to the volatility of a globalized tourism economy as dependence on international tourism growth in the form of organized tours (mainly from China) intensifies. Another threat comes from Western, multinational supermarket chains as they proliferate throughout the country to alter diets, food preparation practices and public eating culture, at a speed that is without historical precedent (Banwell et al. 2013).

At the time of this writing, Thailand's sudden loss of tourism, down by 70 percent due to coronavirus, is proving a grave challenge to overcome (NNT 2020). Floating markets and their food courts have emptied out, even as vendors scrub down market stalls, disinfect surface areas and distribute face masks (NNT 2020; Burton 2020). Thailand's tourism industry has previously experienced major economic disruptions due to natural disasters, terrorism and disease outbreaks (including SARS) and has previously overcome a range of potentially damaging crises by implementing effective risk and crisis management best practices to recover rapidly (Rittichainuwat and Chakraborty 2009; Beirman 2018). Time will tell if the markets are resilient enough to withstand this latest shock.

Findings

Amphawa's planning initiatives aimed to restore traditional waterfront architecture and revitalize food culture to encourage community-based tourism and boost the local economy. In turn, this served to restore intangible forms of cultural heritage, such as performing arts. Thus, cultural activities linked to a reconstructed market identity resulted in multiple social, economic and cultural transformations, positive and negative.

The identity of Thailand's floating markets is changing as job opportunities within the community base shift from agriculture to tourism. As such, the meanings of the floating markets, as symbolic cultural encodings, increasingly represent traditional life as a selling point fabricated to satisfy nostalgic ideas that tourists seek to experience (Suntikul 2017; Thongpanya 2018; Pongjarn et al. 2018).

Despite complex challenges, the revitalization of Amphawa's floating markets serve as a hybrid cultural heritage model that is being scaled up and implemented in several regions throughout Thailand. Though waterfront communities remain in critical need of establishing sustainable resource and tourism management safeguards as tourism becomes less locally driven, there are now more than 60 floating markets throughout the country, including 23 revived markets (Luekveerawattana 2012; Cohen 2016; Ichikawa and Denpaiboon 2017). Still, floating markets—as places where enriching socio-cultural values unfold through traditional foodways—may ultimately offer an indispensable trajectory for Thai food to flourish outside of the globalized corporate food paradigm (Banwell et al. 2013). Overall, the revival of floating markets represents a vital means of multi-pillar recovery whereby traditional food culture binds with contemporary restoration practices to reinvigorate the socio-economic and cultural landscape of the region.

3.1.2. Case Study: Kolkata, India

Description

The megacity of Kolkata, home to twelve million people, has no conventional sewage treatment facility. Instead, this function has historically been undertaken by a community of fishers who farm 125km² area of the greater East Kolkata Wetlands (EKW), a multiple-use ecologically rich area that occupies approximately 12,500 ha on the city's southeastern fringe known as the 'kidneys of Kolkata' (Stigge and Brown 2017), see Figure 4. The EKW supports a traditional method of aquaculture that utilizes the city's sewerage discharge. The treatment and reuse of sewage to support pisciculture and agriculture has long been recognized as a possibility for radically improving urban sanitation, especially in developing countries where it can provide a viable means to support poor communities through processes of circularity that generate sizeable environmental, economic and social benefits (Ghosh 1990).



Figure 4. EKW at Nalban (left) by Biswarup Ganguly 2015 (CC.BY.3.0) and bheri (right) by Sudeshna Ghosh 2017 (CC BY-NC-ND 2.0).

Pisciculture in the EKW supports the largest sewerage-fed fishing enterprise in the world. 264 wastewater-fed fishponds, locally known as bheries, purify approximately 30% percent of the 680 million liters of raw sewage that enter the wetland system every day (Hussan 2016; Ezban 2020). The purified water produces fish for human consumption and is used to irrigate a much larger agricultural area to produce crops that are sold in the city. The method, which acts in tandem with other resource recovery industries, is so effective that the EKW has been internationally recognized as a Ramsar site representing *par excellence* in integrated resource recovery (Chaudhuri et al. 2011).

The Convention on Wetlands was an international treaty signed in Ramsar, Iran, in 1971 for the conservation and sustainable utilization of wetlands in consideration of ecosystem values of economic, cultural, scientific and recreational significance. In 2002, it designated the EKW as a conservation area for the ecological value provided by the wetlands (Kundu and Pal 2008). The multi-pillar benefits provided by the wetlands' communities and the essential services they provide to the greater City of Kolkata

through the recovery and circular reutilization of resources are also widely recognized (Roy 2015; Roy-Basu et al. 2020; Ghosh and Sen 1987; Rojas-Urrego 2017; Kundu and Chakraborty 2017).

The vast majority of people living in the bheri region of the EKW live below the poverty line in slum communities and depend on various resource recovery industries for their livelihoods. These industries take place in the 600+ ha garbage dump known as Dhapa that receives approximately 4000 metric tons of municipal waste daily; 5000 ha of land comprising of 264 bheries (2010) which connect to major and secondary canals that irrigate a patchwork of rice paddies and small-scale vegetable plots with treated wastewater; a network of wholesale food and fish markets; and 43 villages that are home to approximately 60,000 people, of whom more than 90 percent rely directly on the EKW for their livelihoods, with an additional 50,000 indirectly dependent on EKW-related activities for their incomes (East Kolkata Wetlands Management Authority 2010; Bunting et al. 2001; Chakraborty 2016).

The various communities who farm and maintain the tree-fringed canals, cultivate the water hyacinths that absorb pollutants through phytoremediation, provide organic manure for vast amounts of agricultural land and maintain the fishponds that bioremediate a third of the city's sewage and provide fish for Kolkata's residents, do so through a series of integrated ecologically-based treatment processes. Conditions in Dhapa are abysmal and toxic (Doshi 2016), yet the frontline sorting and recovery services these communities provide are essential first steps in a string of bioremediation processes. After separation of recyclables, solid waste is composted. High temperatures generated by garbage sanitize diseased materials and pathogens and supply a growing medium for high value food crops.

Soluble waste is disposed of via raw sewage canals that drain into a series of shallow, flat-bottom freshwater and brackish fishponds to be purified. Solar reactions complete most of the biochemical processes required for remediation. Water hyacinths that grow across the wetlands create buffer zones between land and water to minimize erosion and help with filtration processes. Large numbers of coconut and betel nut trees line the canals, defining the boundaries of the bheries that filter and treat the water progressively as it flows sequentially through a succession of remediating fishponds that are eventually channeled into ponds for farming fish for human consumption. From there, this nutrient-rich water is discharged to irrigate numerous rice paddies and agricultural fields that produce a variety of vegetables, including cauliflower, eggplant, pumpkin, sunflower and basil.

12,000 ha of land are maximized to create benefit from this system of circularity (Chakraborty and Gupta 2019):

Water-based activities (primarily related to sewerage-fed pisciculture)	5852
Agriculture (including productive farming in Dhapa)	4780
Settlement (urban and rural)	1326

This integrated framework has not only crafted a unique foodway that serves Kolkata, but has provided the city with a cost free, environmentally friendly, wastewater treatment system. The salt marshes, salt meadows, sewage farms and settling ponds used to treat Kolkata's sewage also function as a carbon sink and as a purifier for Kolkata's air. Together, these practices represent a rich circular economy and resource recovery and management system. The resulting outputs provide the city with approximately 150 tons of fresh vegetables daily and 13,000 tons of table fish annually (Chakraborty 2016). The fishponds are primarily operated by worker cooperatives, in some cases in legal associations and in others in cooperative groups whose tenurial rights remain under legal challenge (Chaudhuri et al. 2011).

Mudially Fishermen's Cooperative Society

In 1942, a community of fishers in the Howrah district of Kolkata were displaced due to the degraded navigability in the Damodar River. The group migrated to a small wetland area southwest of the greater contiguous EKW region. The area was isolated by dense urban development—a waste dump known as a gathering place for smuggling and other criminal activities. The fishers started farming as tenants for the landowner, Kolkata Port Trust (KPT). In 1961, however, they officially formed the Mudially Fishermen's Cooperative Society. Each fisher contributed 1/4 rupee per day by means of micro-loans or selling family valuables. From these contributions the MFCS leased 250ha of wetlands from the KPT. Over the last 60 years, the MFCS's access to land has been reduced to its current size of 60ha, due to industrial urbanization and large rent increases that has forced the MFCS to downscale. Despite these challenges, the MFCS is responsible for creating a totally self-funded resource-recovery ecosystem that offers a superlative model for integrated wetlands sustainability. The fishers have remediated these low-lying wooded marshes to create a thriving organic aquaculture initiative that successfully farms 31 varieties of fish. Amongst the bheries, they also created the Mudiali Nature Park, a 20ha human-made island constructed from silted soil, that has become a popular eco-park that is open to the public for a small fee (Bera 2015), see Figure 5.

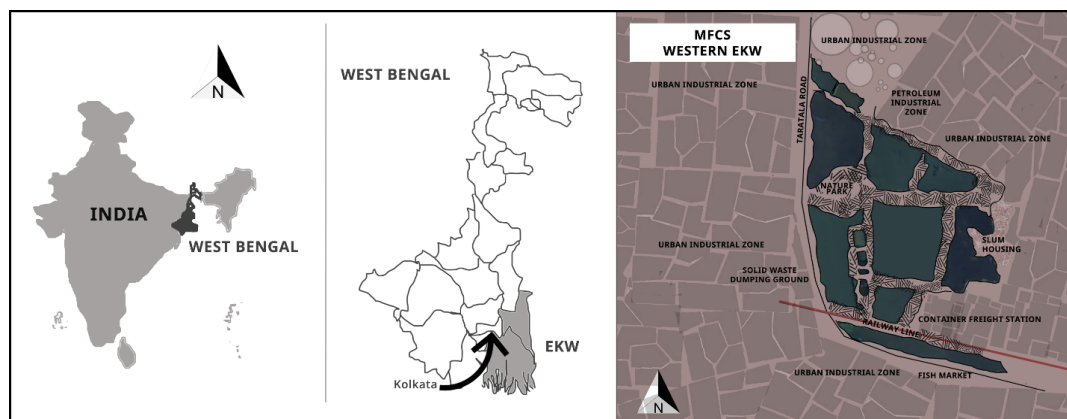


Figure 5. Map of ponds at Mudially Fishermen's Cooperative Society by Lea Rekow 2015 (CC-BY-2.0).

25 million liters of wastewater (70 per cent industrial and 30 per cent domestic sewerage) is released into MFCS's 60ha area from Sonarpur canal daily (Bera 2015). It is treated through a step by step sewage process using six ponds. The first is a stabilization pond where wastewater is treated by adding quicklime. Ponds two through six use water hyacinths to absorb grease and oil. They are populated with varieties of fish resistant to toxic stress (tilapia, nycotica) and air-breathing varieties (singi, magur, koi) that indicate levels of chemical contamination and dissolved oxygen (if the fish jump out of the water to breathe too often, the fishers know the water is still toxic). At each consecutive pond, the water is further cleaned through processes of siltation and adsorption to remove additional heavy metals and reduce coliforms, before it is channeled via tunnels to the next pond. Effluent is tested regularly at an on-site laboratory to ensure there are no harmful chemicals remaining in the water before it is channeled into the ponds that cultivate fish for human consumption. Indian cormorants feed on the fish and in turn leave their nutrient-rich droppings as a source of fish food. The MFCS's tolerance for the birds is an important conservation strategy because most commercial fisheries poison fish-eating birds. The ponds produce tilapia, silver carp and other wild and indigenous varieties at a commercial scale, yielding approximately 13,000 tons (5.5 tons/ha) of fish annually, double or quadruple that yielded by average fishponds (Mahapatra 2015; Chakraborty 2016; Ghosh 1996). The fully treated wastewater is then channeled into a canal which flows into the Hooghly River.

In addition to the fisheries, the MFCS created and established the Mudiali Nature Park by consolidating sediment into a human-made island over time. Members have planted over 100,000 trees, including nitrogen-fixing plants like sababul, used for fish feed, dust- and chemical-absorbing plants like neem and akand and a variety of fruit-bearing trees. Approximately 600 people visit this waterfront recreational park daily. MFCS members also manage a boating complex, with rental picnic spaces and wooden paddle boats that members have made themselves. Due to the addition of the ecopark, the area now attracts 141 bird varieties, including 27 types of migratory birds, 127 plant species and 84 types of butterflies (Bera 2015).

Essential to this diversification is visionary figure, Mukut Roychowdhury, who joined the MFCS as CEO in 1985. Roychowdhury sent MFCS members to the state agricultural university to study pisciculture, began the scientific desilting of ponds, focused activities on creating a more biodiverse ecosystem and broadened the scope of the MFCS to embrace social forestry and ecotourism. He developed a system by which members regularly rotate working activities to retain active membership. All MFCS members, from the administration to working fishers, serve in various capacities, from tending gardens and ponds to working in the office. By all respondent's accounts, this has instilled a sense of collective ownership and responsibility and has resulted in a reduction of alcoholism and drug use amongst members.

The MFCS has 100 members and supports 300 families. It has received the national productivity award for fish production five times. The money earned from the rearing and sale of fish provides a daily per capita income of approximately 70 rupees (US\$4) per day. This is triple India's minimum daily agricultural wage. The MFCS's diversification from pisciculture into commercial goat and duck rearing, fish breeding, horticulture, eco-tourism management of the nature park and social forestry earns the Cooperative an additional 50 lakh (5,000,000 rupees) annually. From this, the MFCS pays for members' children to attend school and provides financial aid for members' medical needs and marriage and funeral expenses. The MFCS also runs a coaching center and a fair-price shop (Bera 2015).

The circular sustainability that the MFCS has achieved, in combination with other resource recovery operations in the greater EKW, ensures that Kolkata's waste retains high value for as long as possible, while cultivating an ingenious foodway that is driven by and supports the poorest of urban communities. These efforts demonstrate that wastewater-fed pisciculture and agriculture can provide a sustainable means for cultivating integrated socio-economic and ecosystem security on a regional scale (Sengupta et al. 2012).

Challenges

Inadequate management of water regimes, industrial pollution, urban runoff and the consequences of urban development threaten groundwater recharge rates, increase flooding and fragment the wetlands to exasperate social, ecological and environmental imbalances (Bhattacharya et al. 2012; Mukherjee 2011). Inadequate legal protections for fishers, a lack of affordable land and pressure from commercialization impede existing livelihood and resource recovery operations as well as scaling-up potential.

Tremendous losses of wetlands and bheris between 2005 and 2016 are evident in comparative satellite images. In 2019, a dire warning that questions if the area will be able to retain its Ramsar-designated status under the collapsing weight of aggressive urbanization was issued by the National Green Tribunal (Niyogi 2019). A reduction in hydrological area in the EKW overall has not only reduced the area available for pisciculture, but its capacity to recycle sewerage waste and mitigate flooding. Additionally, a buildup of siltation in the canals and fishponds has reduced the quantity of sewage flowing to the fisheries and made many of the bheries much shallower, which, in turn, has reduced the ability to farm fish.

The deterioration of wastewater quality entering the canals and ponds due to ever-increasing urban pollution (good quality sewage is critical for sustainable resource recovery) negatively impacts biodiversity, fishpond management, pond ecosystem health and fish yields (Mukherjee 2011). Poor land

use planning, uncontrolled and unauthorized discharge of wastewater containing a variety of chemicals and poor enforcement of existing environmental laws are major stressors that threaten bheri culture. Further, a poor understanding of the pisciculture process (who wants to eat sewerage-fed fish?) causes difficulties in marketing, despite the quality being comparable to other farmed fish in India (Mahapatra 2015). Though non-essential and toxic metal accumulation levels (including mercury and arsenic) in the muscle of the fish farmed are of acceptable levels, more intensive studies are necessary to determine bioaccumulations of pesticides, PCBs and dioxins (Bhupander et al. 2011).

Increases in water temperature due to climate change have negative effects on physicochemical, biological metabolic and physiological behavior of the aquatic ecosystems, adding to compounding anthropogenic threats (Sinha 2014; Das 2014). Unsustainable use of groundwater due to rapid urbanization, industrial development and agricultural expansion pose increased risks of land subsidence (Sahu and Sikdar 2011). As the competition for land between crop-growing enterprises and bheri culture increases, a progressive shift in land use has occurred, leading to a gradual dominance of agriculture, which now accounts for around 40% of the EKW's total area (Bhattacharya et al. 2012).

In 2006, the East Kolkata Wetlands Management Authority (EKWMA) came into effect to prevent unauthorized development, conserve biodiversity, improve the livelihoods of local people and manage the EKW in compliance with the Ramsar Convention guidelines (Kundu and Pal 2008). However, EKWMA is led by personnel who have conflicts of interests and ties to development (TNN 2017). Consequently, it has proposed lifting building and land conversion restrictions and aims to divide EKW into four zones, including one zone with no special regulation (Bhattacharya 2017). This will enable a landgrab that will be disastrous for the ecosystem, the organic recovery system and for the people who manage it (TNN 2017).

Currently, as Covid19 sweeps through Kolkata's crowded slum communities in and around the EKW and many areas become "containment zones", those working in these resource recovery industries become even more vulnerable (Press Trust of India 2020). Climate change, more urban and industrial development and increasing levels of pollution will result in losses of *replenishing loops*: that is, losses in local food webs, livelihood security and further forfeiture of the wetlands. Moreover, the City of Kolkata will be forced to construct a sewage treatment facility at great expense, to replace the services the EKW currently offers at no cost. Threats from externalizing technologies, industry and development interests, constantly imperil ecological and social protections built up carefully and thoughtfully by local resource recovery communities over decades. They jeopardize a traditional culture that literally converts waste into social and economic opportunity—benefiting not only Kolkata's poorest, but the greater City of Kolkata overall.

Findings

In 2019, there were 158 Contracting Parties with 1831 wetland sites, totaling 170 million hectares, designated for inclusion in the Ramsar List of Wetlands of International Importance, 37 of which are located in India (EKWMA 2019). The EKW constitutes a superlative example of integrated resource recovery that can serve as a replicable model for pursuing circular resource recuperation in other Ramsar-designated wetlands sites throughout the country (Mukherjee 2020; Chaudhuri et al. 2011).

The community members that undertake resource recovery in the EKW hold indispensable forms of Traditional Ecological Knowledge that are used to withstand multiple stressors. The functional resilience of the wetlands can be attributed to these communities that optimize natural biorecovery processes to support themselves at the fringe of capital and industry and provide critical goods and services to the greater City of Kolkata. If fishers and other frontline resource recovery workers continue to lose their livelihoods and their meager, self-assembled social safety net, Kolkata will lose an essential foodway, an important wetland and a biodiversity hotspot that processes wastewater for free and acts as a critical barrier to protect from climate change.

The local communities implementing EKW's resource recovery systems provide multiple safeguards for the wetlands. They offer a unique example of how a relatively healthy wetland ecosystem

can be sustained through innovative entanglements involving waste treatment, resource recovery, food production and environmental conservation. Through engaged action and self-mobilization, they have cultivated what human geographer Yi-Fu Tuan calls a “field of care” (1974) for a place that otherwise would have most likely become functionally bankrupt, like so many other places that lie on the urban periphery of the world’s megacities.

3.1.3. Case Study: Rio de Janeiro, Brazil

Description

Globally, the majority of urban farming takes place in poor communities ([Orsini et al. 2013](#)). In Brazil, 7.4 percent of people live in extreme poverty earning less than US\$1.90 a day, with an additional 26.5 percent live below the poverty line, earning less than US\$5.50 per day ([IBGE 2018](#); [Arrais 2019](#)). Of the twelve million or so people who live in the larger metropolitan area of Rio de Janeiro, 96.7 percent live in urban areas. Of the approximate six million who live inside the municipal boundaries, 1.4 million—almost a quarter of the city’s population—live in densely-packed informal or irregular communities (favelas or slums) with little or no State support ([Catalytic Communities, Rio Favela Facts](#) [Rio Favela Facts 2016](#)). Inside favelas, a chronic lack of infrastructure (including a lack of access to clean water, sanitation services, education, medical care) compounds a host of human security issues (including armed conflict). Almost half of residents are functionally illiterate, with many suffering from health problems that lead to a life expectancy ratio that is only half that of those living in wealthier areas of the formal city ([Szwarcwald et al. 2011](#); [The Brazilian Report 2017](#); [National Institute of Studies and Educational Research 2018](#)).

These Brazilians fall mostly into the lowest income bracket, spending approximately 29.8 percent of their earnings on food, with 44 percent of those receiving a quarter of the minimum wage or less experiencing moderate to severe food insecurity ([Câmara Interministerial de Segurança Alimentar e Nutricional 2011](#)). Diets consist almost exclusively of coffee, milk, bread, margarine, rice and beans, with half of all households going for approximately three weeks at a time without consuming vegetables or meats. Thus, in the city’s favelas, urban agriculture is a crucial means of poverty alleviation ([Rekow 2015](#)).

Favelas are resilient and vibrant communities that have long survived as self-sustaining communities. They are also subject to chronic State neglect, poverty, social exclusion, various forms of institutionalized violence and systematized oppression that brings great hardship and insecurity to residents, many of whom have lived under the armed control of drug-trafficking gangs or police militias since the late 1970s and more recently (during the World Cup/Olympic era) under the city’s brutal police pacification campaign ([Rekow 2016a](#)).

Since 2006, the activities of *Hortas Cariocas* (HC), a program of the Municipal Secretary for the Environment’s Agroecology and Organic Production Management scheme, has worked with favela residents in abandoned and degraded public urban spaces and underserved municipal schools to remediate land, establish organic food gardens and institute environmental and food security education programs. The project, conceived of and directed by agronomist Julio César Barros, has co-produced and maintains approximately 38–42 gardens in 24 vulnerable communities and 18 schools throughout the greater city ([Municipal Secretariat for the Environment 2020](#); [United Nations SDG Partnership Platform 2020](#)), see Figures 6 and 7. Due to the project’s ongoing success it continues to expand to establish new gardens, modernize existing ones, and increase the physical size of others.



Figure 6. Garden manager, Orlando de Almeida Ribeiro, with Hortas Cariocas director, Julio César Barros at Hortas Cariocas Formiga garden, Rio de Janeiro, 2014 (left) and a group of children in the HC/Green My Favela garden at Mangueiros 2016, by Lea Rekow (CC-BY-2.0).

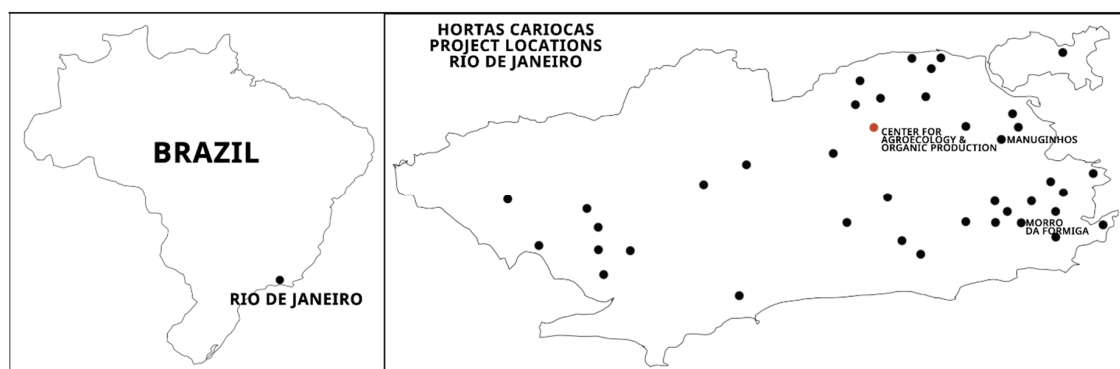


Figure 7. Map of HC's 38 organic food gardens in Rio de Janeiro are distributed across five of the six administrative districts of the city, by Lea Rekow 2019 (CC-BY-2.0).

These co-productions increase food and nutrition security for people at risk throughout Rio's most socio-economically impoverished areas. They are innovative mixes of public and community-led partnerships that work in conjunction with previously incarcerated persons, former drug addicts, ex-gang members, children, retirees, the unemployed, local Residents' Associations, schools, NGOs and other government departments, to create organic urban gardens that:

- remediate abandoned, underutilized and degraded lands;
- provide free and low-cost organic produce to favela residents;
- train and upskill participants;
- establish micro-economies through informal-informal and informal-formal market chains;
- institute environmental, biomedicinal and nutrition education programs;
- introduce food and nutrition education and seed-to-table food programs in schools; and
- fight persistent poverty through improving food and nutrition security and livelihood opportunities in favela communities (Rekow 2017).

The program demonstrates that organic urban agriculture not only has the potential to be an engine for sustainability and a generator of jobs within the informal sector, but a micro-driver for increasing social wellbeing. The gardens provide some poverty alleviation, mostly in the form of income offset. They also provide opportunities to build social capital, reduce environmental threats, improve public space, generate therapeutic health benefits, create hands-on education, present children with a visible alternative to gang culture and increase nutrition uptake for families (Toward the Human City 2016; Hortas Cariocas and Green My Favela 2016; Rekow 2016b). In doing so, they indicate how the enormous challenge of closing the gulf between the theoretical definition and the reality of establishing pro-poor sustainability can begin to be practically realized.

The FAO has recognized urban and peri-urban agriculture as a core means for creating resilient subsistence to protect low-income communities from economic shocks, disruptions and increasing food prices and for advancing socio-ecological development, environmental restoration and food and nutrition security (TCSF 2011). It is recognized as a fundamental means for guiding landscape design and urban planning for Brazilian cities in the 21st Century (ENEPEA 2016).

In Rio's Manguinhos Complex of favelas, where the largest HC garden is located, the Human Development Index is one of the lowest in the city with unemployment rates stagnating at between 30-50 percent (Braathen et al. 2013; Rekow 2015). In this context, urban agriculture becomes a crucial means for building multi-pillar security.

Favelas lack basic sanitation. Almost all function via systems of open sewers built by residents and sanitation services such as garbage collection are either completely absent or grossly inadequate. Therefore, reducing the chronic levels of environmental degradation that favela residents are subjected to living in, by remediating degraded space, is an essential public health service that the HC gardens provide.

In the favelas, non-violent, aesthetically pleasing and productive public spaces are complex and unfamiliar concepts, yet they are foundational to providing the enabling conditions from which informal communities can approach environmental and social repair.

HC gardeners share their knowledge and skills with each other. They freely supplement their family dinner tables with fresh vegetables and fruits as needed and any member of the wider community can come and either freely pick what they need from the gardens to augment their meals, or purchase produce at a cost well below market value. Additionally, half of what is produced is donated to the most vulnerable members of the community (as decided by Residents' Associations). Gardens also contract with municipal schools to provide healthy fresh produce for free school lunches. Inside the school system, growing food has become part of the curriculum, where gardens function as recreational and learning spaces for children. Garden managers are paid small stipends for their work and there is a growing market chain being established between informal-to-formal organic farmers' markets.

Through these city-wide co-productions, HC has crafted a direct relationship to nutritional, pesticide-free food. The types of food grown are decided by the gardeners, but seeds and materials are provided by HC. The produce is typical of what is grown in fruit and vegetable gardens at the same latitude around the world (chillies, lettuce, mustard greens, papayas, okra, cucumbers, melons, eggplant, herbs, biomedicinals and cassava, to name a few) but also offers a glimpse into a social fabric made up of diverse cultural identities through people's migratory histories (many favela residents have relocated or been displaced from more rural parts of Brazil, where different cultural traditions are present).

Because accurate data is so difficult to gather inside informal communities for many reasons, quantifying the amount of food produced in the gardens is extraordinarily difficult, especially as production continues to scale up. However, it is estimated that the HC project produces between 50 and 80 tons of organic food annually to provide for between 20,000 and 100,000 vulnerable citizens (United Nations SDG Partnership Platform 2020; Milan Urban Food Policy Pact 2019).

Also important is the multi-pillar security that food brings to community residents in need. Gardening gives many participants a productive way to spend their days. Education enhances a generation of youth in need of exposure to critical thinking around eating habits and access to healthy, non-processed, supermarket-bought food, as well as the ability to envisage a future with increased possibilities (rather than one defined by limitations).

During the time of coronavirus, HC has been operational in providing both pickup and delivery donations to vulnerable community members, see Figure 8. Catalyzed by an increased need due to the pandemic, the project is also installing small-scale fish farms in communities in order to provide more nutrition, in the form of animal protein, to their benefactors. HC aims to cultivate approximately 3000 tilapia (2500 kg) to donate to favela residents (United Nations SDG Partnership Platform 2020). The wastewater will be used to irrigate the gardens.



Figure 8. HC workers prepare to donate produce to community members during the coronavirus pandemic, April 2020. Photos Rio de Janeiro Municipal Secretary for the Environment (CC-BY-2.0).

Challenges

Developing urban agriculture as a sustainable venture for the urban poor presents core challenges. Key issues include critical deficits in:

- Sanitation and waste management systems;
- Access to health and education;
- Access to microfinancing;
- Formal protection of urban agriculture areas in Rio's Municipal Master Plan;
- Policy support and funding to fight poverty;
- Violence prevention, anti-corruption and transparency governance protocols.

There remain other restrictions to developing food security in Rio's underserved communities. These include a general unwillingness of the State to work cooperatively with informal communities. Unevaluated health risks associated with cultivating food in these areas include a lack of bioaccumulator monitoring and other toxins generated as a result of flooding, the migration of chemicals from nearby industrial activities and air release pollution from traffic congestion. Critical garbage buildup and other problems arising from a lack of public infrastructure services, including a lack of a stable and clean water supply, also present threats. Gardens are also at risk of being built over, threatened by land tenure insecurity and vulnerable to fluctuating levels of urban warfare and gun violence. Projects may also be at risk if gardeners find better paying jobs, or for reasons associated with ill-health or interpersonal conflicts. Though the perceived option value of the gardens remains low (i.e., residents remain concerned that these spaces will not be available to them over the long-term), there is a strong desire to preserve them for future use.

Findings

The economic and health values derived from Hortas Cariocas' foodways include the consumptive benefits that access to healthy, affordable, organic food and biomedicinals bring. The non-consumptive benefits are also substantial. They include educational and social benefits, including the enjoyment of clean, therapeutic and desirable green spaces for children to play in and for people to peacefully gather and socialize with families and friends.

Public security in Rio's at-risk communities remains complicated. It is difficult to imagine how institutionalized racism, persecution and marginalization of favela communities can be rooted out. Yet creative interactions such as urban gardening can catalyze very real interruptions in the dominant power relations inside favelas. They can have extremely positive consequences for residents. They can also generate conflicts and they can fail. More than anything, they represent clusters of micro-level social organizing that emulate ideals laid out in Paulo Freire's *Pedagogy of the Oppressed* (Freire 1970). As promising examples of post-industrial urban foodways, HC gardens provide a platform for acknowledging co-actors, co-learners and co-teachers as part of a process that is fluid,

interdependent, mutual and reciprocal, where collective participation impacts on social reality to elevate the subaltern position and create a bridging framework for community members to more readily have some of their basic needs met (Hsu 2019). HC has proven so successful that Rio de Janeiro has become a signatory city of the Milan Urban Food Policy Pact and, in addition, is now formally recognized by the United Nations as a viable action to accelerate the SDGs (United Nations SDG Partnership Platform 2020).

4. Results

The above cases demonstrate how interrelationships involving socio-environmental recovery, re-traditionalization and re-localization relate to the social dynamics of food culture (Sobal 1999). They illustrate numerous stressors and enormous difficulties that local stakeholders, governance and planning bodies, policy makers and third sector organizations must negotiate (Steffen et al. 2011; Preiser et al. 2018). They also offer expanded understandings of how sustainability initiatives can be formulated across knowledge platforms and between different actors at different societal levels. Further, they suggest how suites of agentic flows can craft context-specific resiliency frameworks to address inequities and rights injustices in low-income contexts (Fernández-Manjarrés et al. 2018; Mirafteb 2009).

In each case, food acts as a cultural component a living lab, a functional concept that operates within a territorial context, bound by multidisciplinary processes that are open, participatory, fluid and connected to how actors perceive a sense of place (Frantzeskaki et al. 2018).

As conceptual frameworks, the cases feed into wider social and political debate about the spatial dimensions of culture—how behavior is located in and symbiotically co-produced by space and place (Moffatt and Kohler 2008). They stand in counterpoint to dominant resiliency initiatives that characteristically protect affluent societal tiers, often at the expense of marginalized communities (Allen et al. 2017). Together, they point to the role that co-creation can potentially play in cultivating a sense of place (Kibler et al. 2018a; Imperato and Ruster 2003; Smith 1973; Arnstein 1969).

Transitioning toward resilience through a holistic approach to sustainability requires people to be able to mobilize, assert their rights, demand political transparency, advocate for inclusion and become involved in building democratic engagement (Cornwall 2002).

The cases discussed suggest that the symbolic role of foodways, together with various constellations of novel actor networks and governance structures, can reshape narratives of place and craft transformative visions for low-income communities to evolve more sustainably (Biggs et al. 2015; Tacoli 2017). These concepts satellite around a set of circularity concepts that have to do with socio-environmental recovery and producing synergistic value creation through cascades of functional restorative effects (Ellen MacArthur Foundation 2019).

In the case of bheri culture in the EKW, recuperative actions associated with resource recovery cascade into foodway security for the greater Kolkata region. These activities remediate water quality and help safeguard against increasingly frequent threats associated with climate change. Additionally, they produce social infrastructure and protections for vulnerable communities to attain a degree of livelihood security. These interlinked systems yield positive human and ecological interactions and sustainable interdependency (United Nations FAO 2018). They produce a highly valuable circular economy that aligns community-level decision-making with sustainability goals (Zucchella and Previtali 2019). They also demonstrate how fragile economies can be impacted by multi-directional flows (both positive and negative) and are highly vulnerable to industry and development interests (Mahmud 2011; Cachelin et al. 2019).

In the case of Thailand's canal-centric communities, the restoration of traditional architecture entwines with the revival of traditional public food culture to interconnect with cultural heritage tourism (for better or worse). This planning approach revitalizes bonds between cultural identity, heritage and a sense of place. These interactions between symbolic language systems reconstruct

structures, practices and traditions (Joassart-Marcelli et al. 2018) that challenge the growing dominance of international supermarket chains throughout the country (Banwell et al. 2013).

In the case of the Hortas Cariocas program in Rio de Janeiro, remediating chronically degraded landscapes to grow food in informal and irregular communities results in increased food security; higher nutrition uptake and access to food as medicine; alternative educational opportunities; safer and cleaner public space; and therapeutic health benefits (such as a reducing hypertension). The HC program also helps mitigate some of the multiplier effects associated with the deprivations endured by those living inside areas of armed conflict in chronic urban poverty. This process-oriented approach positively links local social recovery to the physical remediation and stewardship of degraded lands by cultivating positive attachments to place through sustainability praxes that are supported by municipal-scale policy (Seitzinger et al. 2012).

Hortas Cariocas exemplifies how restorative civic co-productions (Heller 2012; Watson 2014) can align with distributive justice (Roy 2005) to synthesize thinking systematically about resource access, time horizons, governance factors and the importance of partnerships, actions and interactions *between actors* in order to achieve sustainability goals (Nilsson et al. 2018). This suggests that realizing sustainability objectives requires a shared vision and cooperation between top-down actors and local stakeholders and those they represent (Weitz et al. 2018; Cairns 2003).

An examination of these cases suggests that when the focus of a project is on building agency—rather than on an outcome of products—synergistic value creation (the protection of natural, economic, social and cultural resources) can be achieved. This approach resonates with policy and planning concepts associated with the performance economy (Stahel 2010) and circular economic models (Schröder et al. 2019), in that various forms of co-production transform degraded environments into circular and flexible landscapes to sustain the recovery of frontline communities (Amenta and van Timmeren 2018; Remøy et al. 2019).

For these cases, the social psychology of developing a positive attachment to a sense of place (Tuan 1977; Kemp 2011) manifests in contexts where foodways play a binding role at the intersection of collaborative design, governance innovation and socio-environmental restoration efforts. At a broader theoretical juncture, they become more relevant for their contributions to democratic, relational recovery rather than as potential globalizing narratives of resilience (Borie et al. 2019). They show that by linking democratic, municipal-scale food webs to resource recovery networks, opportunities are created that can together aid in alleviating poverty, restoring space, improving health and well-being and building social cohesion (United Nations 2008). They also demonstrate that ongoing justice issues and human insecurity brought about by living in fragile conditions remain critical challenges (OECD 2008; Revi et al. 2014).

Despite limitations, these suites of coordinated sustainability efforts indicate that people living in resource-scarce environments benefit from the integration of processes that simultaneously tackle economic, ecological and social issues of recovery (Cernev and Fenner 2020). They establish that effective socio-economic revitalization actions can reside at the convergence of food culture, resource recovery and environmental restoration. They recognize food security as a core public health goal in crisis recovery efforts for people who suffer from social exclusion and environmental justice trauma (United Nations FAO 2018). They acknowledge provisioning for inclusivity and plurality in planning and governance mechanisms and they value coproduction and societal contributions provided by subaltern sectors to drive agentic flows (Cachelin et al. 2019; Graham and Healey 1999). Further, they identify that social and cultural attributes of food play an essential role in community stabilization and well-being (Weiler et al. 2015).

5. Future Directions in Research

Key areas for directing future research at the nexus of food culture, land use and social capacity include:

- expanding the way place-based revitalization studies can be ‘read’ as living labs;

- enlarging how ‘sense of place’ research can be integrated into broader sustainability frameworks;
- diversifying resilience studies to elevate the value offered by those living in poverty and informal societal tiers;
- broadening understandings of how foodways can bind with restoration ecology initiatives to build inclusive, safe and resilient communities, enhance cultural preservation and identity (tangible and intangible forms) and contribute to furthering a plethora of Sustainable Development Goals;
- increasing studies of and commitments to circular, social-environmental recovery programs located in fragile or resource-stressed regions, especially where people often do not hold full rights to citizenry; and
- examining the integrative and justice roles food plays in cultivating social-ecological restoration and efforts that support the actions of people in various informal/formal/institutional arrangements in fragile contexts.

6. Discussion

The cases discussed in this paper point to how creative entanglements involving foodways can materialize and sustain themselves through the *collective doing of things* (Rekow 2016b). These fluid assemblages of the subaltern and the institutional are subject to the complexity of policy decision-making (OECD 2008) yet ultimately, they demonstrate how micro-territories can be positively shaped by imaginative configurations that demonstrate the benefits of caring for places (Carmona 2019).

They express how food cultures are politicized (Leach et al. 2020; Schanbacher 2010), culturally relative and contextually specific (Kittler et al. 2016). They offer a way to move past replicating unsustainable and inequitable food systems (Weiler et al. 2015). They demonstrate how modifications in policy approaches might help better reconcile Sustainable Development Goals (United Nations Department of Economic and Social Affairs 2019; Akbulut et al. 2019) and align with perspectives of post-growth and post-development (Escobar 2015). They point the way to reconfiguring how negotiating food and socio-environmental restoration politics requires combining plural approaches that are underpinned by diverse agencies and democratized, cross-tier power relations (Leach et al. 2020). Further, they point to policy frameworks that support food systems changes by triangulating approaches to restoration, inclusivity and participatory engagement (Leach et al. 2020).

Sustainable food systems in poor and informal communities are subject to almost constant negotiations that simultaneously involve multiple and competing constructions of oppression and opportunity (Mahmud 2011; Trauger 2014). In marginalized or fragile communities, when ascertaining what should be recovered or why it should be preserved, the *right to decide* (that is, equitably hearing the voices of the local stakeholders) matters a great deal and is essential in understanding place-based social and environmental recovery through wide, democratized criteria (Rekow 2014).

With two billion workers in the Global South employed in the informal sector (ILO 2018) and daily-wage workers increasingly facing hunger, informal food markets play a critical role in ensuring food security in many countries, providing both a source of food and distribution networks for smallholder farmers (Kimani-Murage et al. 2014). Informal and institutional coalitions, cooperatives and associations can act as rich connectors to extend possibilities for integrating sustainable food systems with social-ecological repair (Šūmane et al. 2018; Lehmann 2011). The results can alleviate poverty, make communities cleaner, safer and more desirable to live in and enhance disaster resilience (Cleveland 2013).

At a time when social-ecological restoration theorists are calling for more attention to be given to issues of import in conjunction with issues of process (Wilkinson 2011), regional co-productions involving food and social-ecological recovery offer bridging narratives that can identify promising new opportunities and address key injustices (Cook et al. 2014; Saleh and Rahaman 2014). These systems additionally help mitigate factors that contribute to urban food insecurity, including an overdependence on purchased food commodities, unemployment and underemployment, ongoing reductions in access to peripheral agricultural land and negative climate change impacts (Galal et al. 2010).

The urban poor are the most vulnerable to food insecurity (Kimani-Murage et al. 2014). Populations directly experiencing food insecurity related to ongoing political threats and governance issues (Cernev and Fenner 2020) associated with a lack of land tenure rights, the loss of healthy natural environments to industry and development (Schanbacher 2010), and other forms of accumulation by dispossession (Mahmud 2011; Samson 2015), inhibit fragile sustainability initiatives from better withstanding the multi-pillar shocks and multiplier effects that result from climate change, pandemics and other disaster scenarios (Griffin et al. 2017; Alcayna-Stevens 2016). Anti-corruption and land governance reform measures are also necessary in legal protection frameworks in order for inclusivity and plurality to thrive (Danilo 2018).

7. Conclusions

Societally, many pressing socio-environmental justice concerns could be more effectively addressed by reorganizing how we think about community reconstruction and restoration coalitions (Akbulut et al. 2019). This paper has aimed to demonstrate how micro- and local-level food systems, socio-environmental justice initiatives and socio-environmental restoration activities, interact to revitalize resource-stressed communities, support civic aspirations and rights for those living in informal and lowest-income sectors, enhance social cohesion and cultivate a positive identification with place and culture, despite many complex challenges.

It calls for more fully integrating post-growth and humanistic perspectives into sustainability frameworks in order to increase security for informal and lowest-income societal sectors, while also calling for a greater recognition of the value and services they provide. It has revealed how suites of community-level co-productions involving food and wider recovery efforts can result in positive social and environmental restoration, even though they are limited in reach.

Extending understandings of how foodways integrate with larger capacity-building operations can open up fresh opportunities to rethink how knowledge can be assembled, made visible and transferred. These processes are interfaces for presenting concepts that can be used to restructure and reimagine our ecologies or creative translations of cultural information that point toward embedding food security into sustainability in the most difficult of contexts.

The struggles and *lived experience* of the communities discussed in this paper are illustrative of how regional collectives operate, communicate, collaborate and sustain themselves through cooperative organizational affiliations that create less-industrialized cultures of food (customs, methods and institutional arrangements surrounding structural *reconstructions* of food systems). These creative involvements with food are core components of larger socio-political spaces. They depend on multiple relationships, events and influences that attach to a diverse range of meanings, experiences and behaviors. As local-scale place-based initiatives, they are often hampered by interests and agendas that conflict with their efforts. In the case of Amphawa, responsible tourism has been difficult to achieve, resulting in environmental degradation and the displacement of local stakeholders as wealth becomes concentrated in the hands of a few outside landholders. In the EKW, industry and urban development continues to encroach on available wetlands and threatens bheri culture with increased discharges of pollution. In the case of Hortas Cariocas, mega-urbanization, armed conflict and dispossession of land, particularly throughout the period of police pacification and the leadup to the 2014-16 mega-events, coupled with a historical culture of State abandonment, leaves Rio's informal communities extremely fragile.

Despite these struggles, these cases remain promising examples of integrated co-productions that offer insight into how such place-based initiatives can take hold, even in the face of extreme power asymmetries and inequity. The role these cases play in responding to socio-economic needs reaches beyond the direct value merits of local food production and distribution regimes. Rather, the benefits they bring demonstrate how the culture of food can be used as an inspiring tool for binding community-building to socio-environmental restoration.

These diverse regional initiatives offer adaptable blueprints for evolving co-productions that involve dynamic exchanges between individuals, municipalities, third sector organizations and informal and intergenerational collaborations of many kinds. They have a lot to do with understanding how places can be imbued with (or divested of) constructive meaning. Further, they intimate how the culture of food can be used to reshape attachments to place through expanding ways of knowing, seeing and engaging with neglected space and marginalized populations living on the fringe of contemporary society.

As formulations of more equitable and adaptable social systems, they produce lessons that can help urban planners, policy makers, heritage conservationists, human geographers, landscape architects and justice practitioners understand possibilities for working in resource-scarce or conflict environments in conditions of uncertainty and risk. They offer instruction on how communities can mobilize and how bottom-up and top-down alliances can become networked catalysts for self-reliance and semi-autonomous sustainability.

In order to combat the simultaneous collapses that societies are facing at this historical juncture in time, community-based foodways, as representational components of culture, should be valued for their contribution to resiliency frameworks. As defiant initiatives, as social innovations, as liaisons between the formal and informal, as outreach and human security projects, as environmental restorations and as expressions of cooperation, these diverse and creative foodways are nodes that collectively point toward possibilities for achieving steady-state circular economies, for producing environmentally responsible post-growth agendas and for expanding regional, resilient and sustainable food systems in poor communities on the frontlines of justice struggles in the 21st century.

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