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The Political Ecology of COVID-19 and Compounded Uncertainties in Marginal Environments

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In this paper, we use a political ecology lens to look at how COVID-19 adds to a set of existing uncertainties and challenges faced by vulnerable people in the marginal environments of coastal India. Over the last few decades, local people have been systematically dispossessed from resource commons in the name of industrial, urban and infrastructure development or conservation efforts, leading to livelihood loss. We build on our current research in the TAPESTRY (https://tapestry-project.org/) project in coastal Kutch and Mumbai to demonstrate how the pandemic has laid bare structural inequalities and unequal access to public goods and natural resources. The impacts of COVID-19 have intersected with ongoing food, water and climate crises in these marginal environments, threatening already fragile livelihoods, and compounding uncertainties and vulnerabilities. Extreme weather events such as cyclones, droughts, heatwaves and floods in the last couple of decades have also compounded the problems faced in these regions, affecting seasonal migration patterns. We demonstrate how responses from "above" have been inadequate, failing to address problems, or arriving too late. Authoritarian leaders have used the pandemic to "other" and victimise certain groups and polarise society along religious lines. Lockdowns and covid restrictions have been used to surreptitiously complete environmentally destructive infrastructure projects, while avoiding resistance and opposition from affected local communities, who have also been subject to increased surveillance and restrictions on movement. While state responses have often been unpredictable and inadequate, there has been an outburst of local forms of mutual aid, solidarity, and civic action. There are also many examples of resilience at the local level, especially amongst communities that have largely relied on subsistence production. Despite the acute suffering, COVID-19 has also prompted civic groups, activists, and local communities to reflect on the possibilities for reimagining transformative pathways towards just and sustainable futures.

Keywords: COVID-19, political ecology, compounded uncertainties, Kutch, Mumbai, India, care, solidarity

INTRODUCTION

The world has changed dramatically since early 2020. First, we witnessed a massive loss of lives and livelihoods due to the COVID-19 pandemic, combined with ongoing climate, water and food related uncertainties and crises. In India, this resulted in a massive crisis of migrant labour having to move back and forth between rural and urban areas (Aajeevika Bureau, 2020). Secondly, these losses have taken place against the backdrop of growing far right, authoritarian politics in both the global North and South. Political leaders have promoted vigilante nationalism, supporting violent acts against minorities, and clamping down on democratic rights of protest and dissent, while promoting neoliberal projects exacerbating the marginalisation and dispossession of local people. This is particularly true of India, a country that has experienced two devastating waves of COVID-19 (April to September 2020, and March to June 2021, respectively).

In this paper, we take a political ecological approach to examine how COVID-19 intersects with existing uncertainties in two coastal "marginal environments" in India—coastal Mumbai and coastal Kutch. These locations are disaster-prone, characterised by acute climate uncertainties where events such as drought, extreme rainfall events, floods and cyclones intersect with the uneven impacts of capitalist expansion. These compounding factors threaten people's wellbeing as well as their sense of place and identity, contributing to growing inequality and the vulnerability of marginalised people (Mehta et al., 2021).

Our findings are based in-depth telephone interviews, digital research, secondary literature and news media, and insights from webinars and online discussions, supplemented by in-person visits to our research sites in autumn 2021, as restrictions eased. Given the constraints of the pandemic, physical fieldwork was initially impossible, requiring a greater reliance on remote interaction, technology, and digital media (cf. Keleman Saxena and Johnson, 2020; Wood et al., 2020). In Kutch, telephone interviews were conducted in August 2020 and January 2021. Access to informants was often restricted by poor network connectivity, and a gendered skew of mobile phone ownership meant we were mostly able to interview male Jat herders, technology-specific issues similar to those encountered by other researchers during the pandemic (e.g., Lorea et al., 2021; Mahtab, 2021). We conducted a short field visit to Kutch in October 2021. In Mumbai, we were able to draw on insights from pandemic relief work conducted by staff and students at IIT-Bombay, Koli protests against infrastructure projects, and WhatsApp messages shared by Koli fishers, particularly during the first lockdown. In September 2021, Mehta and Parthasarathy conducted two rounds of physically distanced fieldwork in coastal Mumbai. We draw on materials from field research carried out prior to the pandemic and insights from long-term fieldwork conducted in the two research sites, with relationships and institutional connexions sustained over multiple decades. Like Gonda et al. (2021), throughout the pandemic we have personally also experienced new uncertainties and vulnerabilities due to the inability to conduct fieldwork and not being able to physically connect with local communities and research partners in our field sites.

The paper begins by exploring how political ecology and feminist lenses can make sense of increasing compounded uncertainties during COVID-19, and their links with intersectional processes of marginalisation and vulnerability. We then examine the trajectory of COVID 19 in the Indian context. Case studies from Kutch and Mumbai focus on the intersections of these compounded uncertainties and their impacts on different marginalised social groups, as well as bottom-up examples of care, solidarity, and civic action. The paper demonstrates the need for the political ecology of COVID-19 to addresses issues concerning the politics of uncertainty and the need to integrate issues of care and justice in future studies of the ongoing pandemic and its recovery, over and above the study of intersectional processes of marginalisation and a critical study of the politics of state and policy processes. We conclude by exploring diverse pathways to mitigating impacting and recovery, highlighting the need to learn from bottom-up civic action and solidarity.

COMPOUNDED UNCERTAINTIES DURING COVID-19

Between 2020 and 2021, countries in both the global North and South have experienced extreme events such as floods, heatwaves, and cyclones on top of the uncertainties and suffering caused by the COVID-19 pandemic. Climatic shocks and hazards are increasing both in frequency and intensity (IPCC, 2021). For example, Mumbai experienced two cyclones in this period— Nisarga in June 2020 and Tauktae in May 2021, a rare conjuncture in the history of Arabian Sea cyclones. As Phillips et al. (2020) argue, these intersect with COVID-19 impacts, relief measures and state responses, requiring local people and policymakers to react not just to the pandemic, but also other ongoing hazards.

We refer to these as compounded uncertainties (Phillips et al., 2020; Pickard et al., 2020; Srivastava et al., 2020). These are multiple uncertainties occurring in spatial and temporal proximity, leading to processes and outcomes that are hard to predict and plan for. Such uncertainties may be triggered by a single event (e.g., a climate or health hazard) but cascade into other economic (e.g., loss of livelihoods), social (e.g., violence, stigma, and marginalisation), and political domains (e.g., rising authoritarianism or increased state surveillance) (Phillips et al., 2020; Srivastava et al., 2020). Systemic inequities and failures put those most vulnerable at further risk, as they are unable to recover or remain resilient in the face of multiple shocks within a short period of time.

We believe that this focus on compounded uncertainties contributes to our understanding of the political ecology of COVID-19 in two critical ways: (1) While the pandemic has been devastating for poor and marginalised communities, there are risks that it becomes the only microcrosm through which we view lives, nature-society relations and livelihoods in carona times. Instead, the impacts of the pandemic have intersected with other uncertainties and crises, often magnifying the vulnerabilities of poor and marginalised people, with impacts differentiated across class, caste, and ethnic lines. (2) Yet, given that communities

at the margins have been living with a range of uncertainties for long time (especially climatic shocks and stresses), they have repertoires of past experiences and knowledges to adapt to uncertainties. They also often resort to bottom-up solidarity, processes of care and civic epistemologies that help in recovery and bottom up processes of change. These issues thus call for focussing on the politics of uncertainty as well as care and justice in future studies of the political ecology on the ongoing pandemic and its recovery, over and above the study of intersectional processes of marginalisation and a critical study of the politics of state and policy processes.

In India, the COVID-19 pandemic coincided with climate shocks and stressors including Cyclones Amphan (West Bengal and Orissa) and Nisarga and Tauktae (Gujarat, Karnataka, Maharashtra) as well as flooding, heatwaves, and drought in different parts of the country. These events challenged communities that were already facing lockdown restrictions. Compounded uncertainties disrupted immediate responses to both COVID-19 and natural disasters, and have also had longer term impacts on the adaptive capacity of social and ecological systems.

For example, during the pandemic the remote islands of the Sundarbans, a delta across India and Bangladesh that is known globally as a climate hotspot, have witnessed two cyclones: super cyclone Amphan in May 2020 and cyclone Yash in May 2021 (Ghosh et al., 2022). The compounding impacts of the COVID-19 lockdown, returning migrant workers, and this cyclonic storm event presented multiple challenges to authorities and local people. Despite early warning systems, the state government's response was compromised by the pandemic. Several cyclone shelters had been converted to quarantine centres, leaving hundreds of people confined in fewer shelters than normal, compromising COVID physical distancing protocols. The cyclone disrupted essential supply chains, impeding the delivery of public services and humanitarian relief, and affecting islanders' access to food, health, water, and livelihoods (Srivastava et al., 2020). This example highlights the importance of addressing how the pandemic has exacerbated vulnerable populations' existing food and livelihood insecurities, particularly as these intersect with disasters and seasonal uncertainties.

As in the above example of Sundarbans, marginalised people in both Mumbai and Kutch have been confronted with climate-related uncertainties, difficulties in sustaining livelihoods, displacement or dispossession by infrastructure or conservation projects, and the impacts of neoliberal, unequal patterns of growth. In urban Mumbai, poor people living in flood-prone areas lack rights to formal housing and basic services, increasing their vulnerability to climatic events. This was particularly apparent in the city's coastal fishing villages—Koliwadas—which have reported increasing storm surges, salinity intrusion, and inundation in their habitations. At the same time, the Kolis are often unjustly blamed by the state for encroaching on fragile coastal environments and held responsible for floods and other extreme events. This is despite Koliwadas' contribution to conserving coastal ecosystems such as mangroves, which protect against flood risks. In Kutch, pastoralists need to deal with changes in rainfall and declining grass cover, alongside hostile

government policies and rapid industrialisation that have led to their dispossession from the commons (Mehta et al., 2019). This is also a result of biassed state policies that denigrate pastoralism, blaming it for environmental degradation. In both environments, the experience of the pandemic has intersected with pre-existing vulnerabilities and exclusionary policies.

As existing literature on the political ecology of disaster shows, there is no such thing as a "natural disaster" (Smith, 2006; Collard et al., 2018). While the origins of COVID-19 are still disputed, its impacts in particular places have exacerbated existing local inequalities of race, caste, gender, ethnicity, income, and informality, intensified by uneven geographies, political economics, historical and sociocultural dynamics (cf. Collard et al., 2018). As with climate change and other disasters that are made out to be "natural" or "acts of God" beyond human control, a political ecology framing highlights how compounded uncertainties have anthropogenic causes and are socially and politically induced. They are part of the "social and biophysical forces through which lived environments, with all their engrained inequalities and forms of power, are actively yet unevenly produced" (Taylor, 2015, p. 19).

Uncertainties around floods, droughts, cyclones, rainfall variability and extreme weather events are experienced in both Mumbai and coastal Kutch. Dominant pathways to deal with climate-linked uncertainty range between capitalist and growth driven trajectories to apathy and neglect of the vulnerabilities of poor people. To understand these intersections of climate with capitalism, we build on Douglass and Miller (2018) conception of compounded disasters, looking at how the spatial and/or temporal proximity of ecological, epistemic and political economy of uncertainty can have compounding and cascading effects (Srivastava et al., 2020).

We also draw on a post-structural understanding of knowledge as something socially constructed and inherently plural and partial (Haraway, 1988). Different actors have framed the COVID-19 pandemic and its related uncertainties in different ways, guided by the knowledge systems in which they are embedded. Thus the pandemic can be viewed as health crisis or as a failure of governance or state preparedness (Srivastava et al., 2020). These divergent framings highlight how the pandemic and its interactions with are socially and politically constructed by people, communities, and institutions, and how these constructions shape different—often contrasting—responses.

Several studies have documented how communities who are highly exposed to climate variability adapt to uncertainty (Scoones, 1994; Mehta, 2005; Hastrup, 2013; Rudiak-Gould, 2013). In Kutch, for example, local communities have responded to drought-related uncertainty by adopting diverse strategies to cope and live with water scarcity (Mehta, 2005). In the first wave of COVID-19 cases, this helped these communities cope with a lack of state support and restricted access to shops and markets. The second wave, however, overwhelmed all, in urban and rural areas alike (Bhatt et al., 2021). Similarly, in Mumbai, Koli artisanal fishers could usually depend on marine fishing for food and income security, a livelihood strategy adversely impacted by lockdown restrictions in both the first and second waves.

In India, as in the UK, Brazil and the USA (under Donald Trump), pandemic responses from "above" have been inadequate and mismanaged (Pickard et al., 2020). While some Indian states have responded with greater transparency and accountability than others in handling the pandemic (e.g., Kerela and Maharashtra) and several officials have gone out of their way to provide support and relief to poor communities, it is now well-established that the Central government's response has largely been hubristic and blind to the situation of the problems of the poor, minorities and vulnerable people (Bhatt et al., 2021). In the absence of state support, bottom-up solidarity and civic epistemologies have come to the aid of smallholder farmers, informal workers, and marginalised people. These civic epistemologies are reflected in bottom-up research by communities, civil society actors, and low-level government officials, acting with the support of engaged academics to produce knowledge about logistics, sites of marginality, finances, accountability and transparency, epidemic management, sanitation, and food supply (Kamath et al., 2020; Kundu, 2020; Parthasarathy, 2020). Ideas of care deployed in feminist political ecology (FPE) help in stressing the role of coping and recovery from the pandemic, based on a commons of caring relations oriented towards wellbeing and equity (Mehta and Harcourt, 2021). This emphasis highlights the importance of conviviality and solidarity. While care is a "deeply gendered and time-consuming activity performed to support the bodily, emotional, and relational integrity of human beings" (Gregoratti and Raphael, 2019, p. 92), it is also an ethical concept, recognising all that we do "to maintain, continue, and repair our world" (Gómez Becerra and Muneri-Wangari, 2021, p. 11). To value care is to acknowledge our mutual interdependence and the need for sustainable flourishing relations, beyond instrumentalism or mere survival, as we rebuild the commons (de La Bellacasa, 2017, p. 41).

In a context of compounding uncertainties, the inability to sustain care regimes prevents communities, households, and individuals from pursuing a "rich plurality of life-activities" (Nussbaum, 2000, p. 54), as in Aristotelian notions of eudaimonia or flourishing. Integrating political ecology and this ethic of care requires us to reject any clear-cut distinction between care and justice (Okin, 1989), as Parthasarathy (2018) argues in his critique of disaster governance in Mumbai. Cascading disasters and compounded uncertainties demand institutions and strategies that show "capacities for empathy, care, and concern for others" (Okin, 1989, p. 248). These capacities were largely absent in the Indian state's pandemic response, but very much visible in the actions of civil society groups. Finally, feminist political ecology also forces us to pay attention to intersectional differences, embodied experiences of climate change and the pandemic, and different vulnerabilities between different groups of people and nature (cf. Tschakert, 2012).

COVID-19 IN INDIA

The COVID-19 pandemic in India, especially the first wave, revealed the interplay of inequality and vulnerability. The spread of the virus compounded uncertainties for poor and marginalised groups, leading to insecurity, stigma, and a severe loss of livelihoods. A draconian national lockdown, announced with 4 h' notice, confined a population of 1.3 billion to their homes. This destroyed farmers' incomes and triggered a mass exodus of migrant workers from cities, placing additional pressures on India's rural communities (Pickard et al., 2020).

The first lockdown also coincided with the monsoon season ban on fisheries that affected most coastal areas in India. The effects were compounded by cyclones and storms in both years that exacerbated uncertainties, especially for women, who play an important role in fish processing and marketing and were disproportionately affected by the resulting loss of income (see Section The Political Ecology of COVID-19: Crisis and Response Among the Kolis of Mumbai, below). The Koli artisanal fishers reported significant damage to boats, loss of life, and income from these cyclones.

As with other disasters and uncertain events that have been politicised to achieve certain ends (Mehta et al., 2019), the pandemic in India has prompted sectarian and authoritarian responses. Rather than treating COVID-19 as a public health disaster, the state responded to the pandemic as a law-and-order problem, criminalising dissent, and detaining those who failed to comply with stringent lockdown rules. These include many activists and state critics who have been arbitrarily detained and are still in jail. Indian jails are congested in the best of times, but during the pandemic this congestion led to additional risks and vulnerability to COVID-19. Migrant workers were particularly hard hit—both by lockdowns, and the state's failure to provide relief, transportation back to their towns and villages, and effective compensation to ensure food and income security. While the first lockdown may have been necessary given India's large population, its severe enforcement has been criticised as more spectacle than governance, geared to achieve maximum visibility for the government (Pickard et al., 2020).

India's first and second waves laid bare existing structural inequalities of caste, class, religion, gender, and education. Existing vulnerabilities hastened the virus's spread—a product of elite biases and unequal political and economic systems. COVID-19 has demonstrated the need for universal social security coverage, including basic shelter, food, water, and sanitation for all citizens of India.

India's second wave was the worst humanitarian and public health crisis the country has witnessed since independence (Bhatt et al., 2021). Countless lives were lost as the surge overwhelmed the country's health infrastructure, leaving people scrambling for hospital beds, critical drugs, and oxygen. With limited government support, many urban Indians took to social media, "sending emergency SOS requests in a desperate attempt to crowdsource vital resources for their families and friends" (Kaul and Kumar, 2021). Official statistics were distorted by a sharp undercounting of cases, infections, and deaths. India's reported COVID-19 fatalities have probably been underreported by a factor of between three and ten (Bhatt et al., 2021). When infections started to fall in urban areas in May 2021, the effects of the second wave continued to be felt in rural areas (Panneer et al., 2022). At the same time, Cyclone Tauktae hit coastal areas

in western India, including Mumbai and parts of Gujarat, with both regions entering the leaner livelihood seasons of monsoon and summer, respectively.

During the pandemic, vulnerable and marginalised people including informal workers, migrants, and rural communities have been hardest hit in terms of their access to healthcare and livelihoods. The pandemic highlighted how Indian cities depend on informal, unregulated activity to keep running. Impacts were felt particularly keenly by those in precarious employment, including women, migrant labourers, and informal workers in both rural and urban areas (see Section COVID-19 in a Context of Uncertainty: The Jat herders of Kutch on Kutch for impacts on rural areas). The pandemic has had very severe impacts for women, given their high involvement in the informal sector. Often employed in unrecognised or informal sectors, the absence of women from the labour force is less likely to be registered in official statistics, calling for more granular, disaggregated data collection in order to address gender-based vulnerabilities during the pandemic (see Bhatt et al., 2021).

At the same time, COVID-19 has reinforced the marginalisation and stigma of minorities, including Muslims and Dalits. The National Campaign on Dalit Human Rights (NCDHR) noted that existing caste and ethnicity induced vulnerabilities have been amplified by the pandemic, laying a "backbreaking burden" on India's marginalised Scheduled Caste and Scheduled Tribe communities. The impact of lockdown was felt more keenly by already marginalised and vulnerable sections of society, many of whom have been stigmatised as likely carriers of the virus (see Pickard et al., 2020). Reports by Ajeevika (on migrant workers) and Oxfam (on health impacts) note the role of the pandemic in amplifying the precarity of those already facing discrimination due to their regional, religious, and caste identities (Thomas et al., 2020; Oxfam India, 2021; see also Pickard et al., 2020).

COVID-19 has intersected with and multiplied existing uncertainties faced by vulnerable groups and communities who have remained largely invisible in India's development storey. In the following sections, we turn to two of these vulnerable communities, presenting case studies from Kutch and coastal Mumbai.

COVID-19 IN A CONTEXT OF UNCERTAINTY: THE JAT HERDERS OF KUTCH

Kutch is the second-largest dryland tract in India. Although the region is arid to semi-arid, this largest district of India has a wealth of ecosystems within its borders, including seasonal wetlands, thorn forests, grasslands, desert, and a long coastline with lush mangrove forests. Historically drought-prone, Kutch's variable water supplies and erratic rainfall patterns have always made life uncertain (Mehta, 2005). Pastoral, farming, and fishing communities have harnessed this variability by developing a symbiotic cultural relationship with these habitats over several centuries (KUUMS, 2013; Srivastava and Mehta, 2017). However, in the past decade, Kutch has been confronted by additional

climate-related uncertainties in the form of extreme patterns of variability, including floods. Although people in Kutch have adapted to ecological uncertainties, many are now struggling to cope as these changes intensify and are exacerbated by other social and economic challenges (Srivastava et al., 2022).

Following the 2001 earthquake, which ravaged the district, the Gujarat state government pursued aggressive industrialisation in the name of "development" (Kohli and Menon, 2016; Sud, 2020), leading to rapid investment in infrastructure and major industrial projects, including ports, thermal power plants and cement factories (Srivastava and Mehta, 2017). More recently, Kutch has become a favoured destination for renewable energy (solar and wind) parks, attracting widespread attention and investment (Nair, 2020). This rapid industrial growth has been largely achieved at the cost of irreversible environmental destruction, with changes in land use patterns leading to dispossession of local communities from local lands and commons (Mehta and Srivastava, 2019). Sporadic industrial development in some of Kutch's most ecologically sensitive areas has affected resource dependent livelihoods and the health of this vibrant ecosystem (Kohli and Menon, 2016).

COVID-19 and Cascading Uncertainties

Although the brutal impacts of India's first lockdown were felt across rural and urban livelihoods, the plight of pastoralists remained invisible to the mainstream discourses on livelihood loss and post-pandemic recovery. As Iyengar notes, "the pastoralist lifestyle is poorly understood by the society because pastoralists live on the margins—environmentally, socially and politically" (Iyengar cited in Baker, 2020; also see Mehta, 2005 and Mehta and Srivastava, 2019 for marginalisation of pastoralism in Kutch). With sales of milk and other animal products suspended, and scarcities affecting inputs to livestock upkeep, the pandemic's disruption of agricultural market linkages threw different pastoral groups across India back into abandoned subsistence livelihoods (Pickard et al., 2020). In Kutch, however, herders' established relationships with farmers across the district and the state of Gujarat enabled them to draw on shared histories of receiving fodder and exchanging manure, a cheap fertiliser, for cash or grain. Expected to benefit both parties, these interactions and relationships going back centuries represent an example of care as exchange, and are contingent on herders having something valuable to barter (cf. Gómez Becerra and Muneri-Wangari, 2021). Lacking these advantages, pastoralists elsewhere in India (e.g., Gaddis, Gujjar, and Bakarwal herders in the north of the country) were caught out by lockdown restrictions, which prevented them from returning to their villages (Maru, 2020; Pickard et al., 2020).

In Kutch, the first case of COVID-19 was recorded in Lakhpat taluka (sub-district), adjacent to our research site in Abdasa. Around 30 families with 500 kharai camels use the tropical thorn forests and mangroves in these areas to graze their animals (Mehta et al., 2021). Several herders whom we spoke to in 2020 mentioned that many thought this virus to be a recurring disease, *Mata*, that often affects livestock in the month of March. For example, one herder mentioned: "Allah (God) knows what this disease is? I think this is the deadly Mata disease, a mahamari

(epidemic) and there is no cure for it" (Interview: 17th August 2020). It was news of the lockdown that first made these herders aware of COVID-19. For instance, Saiba *ben* (sister), in Mohadi village, who often shares herding responsibilities with her husband, told us she did not know anything about the virus until they heard about the lockdown (Interview: 17th August 2020). Given the size of the country, different states and regions experienced waves of infections at different times. Initially, much of the focus was on the major urban centres such as Delhi and Mumbai, which were experiencing rapid increases in case numbers, not the country's smaller towns and villages. Cases in Kutch only peaked in July 2020, restricting access to neighbouring towns for several months.

The 2020 lockdown protected these coastal villages from high case burdens during the first wave. In the second wave, a patchy and delayed state response allowed the virus to run through the local population. Across rural India, including Kutch, local people brushed off the symptoms as "seasonal flu" reporting high fever and shivers (Mitra and Maggu, 2021). Testing was patchy and several people resisted going to the health centres for fear or stigma and imminent death. In a Sahjeevan survey of 95 pastoral households across Mitra and Maggu (2021), there was a widespread lack of awareness about symptoms, preventive measures, diagnosis, treatment, and vaccination (Sahjeevan, cited in Mitra and Maggu, 2021). In later sections, we describe some of these communities' lived experiences, showing how pandemic-related uncertainties compounded existing vulnerabilities, cascading into other sectors such as food security and mobility.

The immediate effects of the lockdown were experienced in terms of mobility restrictions and a lack of food supplies. Mobility is the lynchpin of any pastoral system, allowing herders to manage seasonal variation in fodder availability, unpredictable water supplies, erratic rainfall, and climate-related uncertainties. Even in normal times, the mobility of Jat herders has been limited in coastal regions of Kutch. As a border area, the threat of terrorism is often used to justify restrictions on their movement (Ibrahim, 2021; Srivastava and Mehta, 2021). The Border Security Force (BSF) and Forest Department have both imposed severe restrictions on access to creeks and mangrove islands, using punitive measures to control the movement of local herders (Srivastava and Mehta, 2017). Our interviews revealed how an increased BSF presence has restricted women's movement to the mangroves and outside the village (Interviews: May 2019 and January 2020).

In summer (March to June) and winter (October/November to February), kharai camels are taken to bets (islands) near the creeks to graze on mangroves for 2–3 days, before returning to the mainland to access fresh drinking water (pers. comm Sahjeevan). The 2020 lockdown coincided with the crucial summer months, when securing sources of fodder and water has always been challenging. Several herders we spoke to described the problem of fodder and access to pastures early in the lockdown. The police and other authorities were strict in enforcing lockdown restrictions, with no more than three people permitted to visit the bets. One pastoralist said "kya karein, hum khakhi dekh ke darr jate hain *[what to do, we fear the khaki clad police officers]*."

Since the lockdown was declared at short notice, many were unable to return to their villages, or arrange sufficient food supplies for their families. Since pastoralists are always on the move and may lack ration cards, many struggled to access government relief (Pickard et al., 2020). These herders' villages are in remote border areas, so access to hospitals, banks and shops was highly limited. A Jat herder remarked: "food is a big problem; everything is closed, and the shops and markets are also quite far." A member of Sahjeevan, a NGO working with camel herders, agreed:

> "Many of the *oont wale* (camel herders) work 10–20 kilometres away, near forestland or commons. They have no contact with the villages or with government. Many of them keep their ration cards in their villages while they are roaming somewhere else [...] Now there are no buyers for camel milk and other products of the *maldharis*, so their income has stopped, and they can't buy essentials. They are also scared to go back home as in some villages, they will not be allowed in." (Bhatti cited in Mukherjee, 2020.)

With the lockdown, all forms of livelihoods were exposed to shocks, albeit to varying degrees. Milk collection and supply chains have suffered throughout the pandemic. Camel milk thus has been shared amongst the villages during this period. Many of the young herders who had eventually taken to working as casual labour in the nearby cement factories also lost their jobs or did not receive their monthly salary (Interview: August 2020). The lack of mobility and suspended livelihoods meant that there was no liquid cash to purchase food and other essential commodities. Many of the herders we spoke to during the lockdown told us "pastoralists who relied on camel were better off than those working in factories" (Interviews with camel herders: August 2020).

With the help of camel herders cooperative KUUMS, Sahjeevan was able to trace herder families, providing food kits (grains, spices, etc.) to last for a month during the lockdown. As the lockdown was lifted, herders were able to move around, though there were still restrictions of mobility. Many herders complained of high transport costs, which affected their access to essential services (health care, medicines, and food).

In September 2020, as Kutch began to emerge from the economic devastation wrought by lockdown, the region experienced flash floods, submerging fields and farmland. One of the herders remarked:

> "The fields and farms however were full of water, it looked like a river. There is still some water in some areas. I don't have a farm. We did not know about the rain. No one told us about it. The grass cover was full though." (Interview: August 2020.)

The impact of excessive rainfall was unevenly distributed; herders benefitted from good grass cover, with fodder and water both available, but many farmers lost their crops.

Care and Solidarity at the Margins

In rural areas across India, including Kutch, the first lockdown coincided with the harvest of rabi (winter) crops (wheat,

mustard, potato, chickpea). With limited labour and agricultural equipment, and restrictions on movement, farmers had difficulties storing, distributing, and exporting their produce (Pickard et al., 2020). Some dumped perishable goods or used crops for animal feed, while others were forced to rent storage space for produce that would otherwise have been left in fields, vulnerable to rain and pests. In Kutch and other parts of the country, many farming families moved to subsistence crops, with access to non-market food sources and their own produce alleviating some of lockdown's pressures on food supplies. Non-agrarian rural livelihoods also experienced hardships and came to a standstill during lockdown.

As argued above, Kutch has largely been a subsistence economy. Local people have developed intricate ways of living with uncertainties, including reciprocal systems of exchange (Virmani, 2020). Before the introduction of fertilisers in the 1970s, farmers and herders shared a symbiotic relationship, where farmers would invite the camels for penning in their fields, in exchange for fodder. With Kutch's rapid integration into the market economy in the past 15 years, these networks and systems were marginalised, if not completely eradicated. Within pastoral households, livelihoods have become increasingly diversified. Some people engage in dryland agriculture, fishing or work for the cement and salt factories. Few young people want to get involved in herding, put off by uncertain and variable incomes.

With normal economic activity suspended, the lockdown revived this abandoned subsistence economy, while simultaneously "galvanising local forms of moral economy and solidarity" (Simula et al., 2021). In Kutch, many Jat families were able to endure the pressures of lockdown because they were less "strongly integrated with the market" than other livelihoods, such as cash crop farmers and craft workers (Virmani, 2020). Elsewhere in the region, Rabari pastoralists were able to hold their stocks while the export of live animals was restricted, relying on grain from farmers and ancillary income sources (leasing land to contract farmers, renting agricultural equipment, etc.) while waiting for prices to recover (Maru, in Simula et al., 2021, p. 60–61). Pastoral and farming communities provided food and milk kits to families of migrant port and factory workers, who were trapped in these regions by the lockdown. Solidarity and cooperation between migrant labour, farmers and pastoralists was seen in various villages on the Kutchi coast (Virmani, 2020).

THE POLITICAL ECOLOGY OF COVID-19: CRISIS AND RESPONSE AMONG THE KOLIS OF MUMBAI

Most COVID-19 cases in India's first and second waves were reported from in urban areas (Gupte and Mitlin, 2021). Pandemics such as COVID-19 depend on socio-ecological interactions, and these are often more intensely felt in the cities of the global South. Globally, around a billion people operate under conditions of urban informality and precarity, often lacking access to formal services such as water, sanitation, secure housing, access to health care etc. (Gupte and Mitlin, 2021). A combination of dense informal settlements, intensified

rural-urban migration, and new urban infrastructure projects are creating zoonotic "accelerator landscapes" (Gandy, 2022, p. 6–8). Migrant labourers and informal workers dependent on forestry, fisheries, agriculture, and pastoral landscapes connect cities to rural areas, creating vectors for viral transmission, while compounding the impacts of pandemic management strategies such as lockdowns.

Mumbai's is one of India's largest urban agglomerations with a history of colonial development around trade, manufacturing, and shipping. From the 1980s onward, as manufacturing declined, the city became a key site for services, finance, information, technology, entertainment, and media. While a large proportion of its population live in informal settlements, studies in recent years have focused on the neoliberal transformation of its coastal ecosystems and resource commons on which the city's earlier inhabitants—the Kolis— have traditionally laid claim (Parthasarathy, 2011; Kamath and Dubey, 2020; Parikh, 2020). The Kolis are artisanal, small scale fishing communities who have enjoyed de facto and de jure rights over the coastal commons which have served as spaces for living, livelihood, and as community spaces. Fishing villages predating the development of Mumbai as a colonial metropolis continue to exist, despite encroachments on their land, the pollution of creeks, beaches, and coastal waters, and destruction of mangroves. Increased competition from commercial trawlers, the use of the ocean for blue economy projects such as offshore oil, and elite infrastructure projects developing coastal land and the sea have further threatened the livelihoods of the Kolis and their coastal commons.

Amid these developments, the city has experienced increasingly frequent extreme precipitation and flood events, with the 2005 floods being the most severe (Revi, 2005). Coastal erosion, rising sea levels, storm surges, and salinity intrusion are severely affecting Kolis' residential spaces, housing, drinking water, jetties, parking spaces for boats, and coastal habitations used for fish markets, boat building, and net repair. As the climate-linked warming of the Arabian Sea creates new uncertainties for the coastal fishers, annual flooding in these villages has become the norm, exacerbated by poor flood risk mitigation by the city municipal corporation and Mumbai Metropolitan Regional Development Authority (Parthasarathy, 2016; Adam et al., 2018).

A neoliberal model of urban growth based around the development of coastal real estate has long been a threat to Mumbai's Koliwadas (the villages inhabited by the Kolis, and over which they have customary rights as commons, Parthasarathy, 2011). From the 1990s, large memorial projects pushed by right wing majoritarian political parties (Thackeray memorial, Shivaji Memorial), and transport infrastructure projects to meet elite needs (Bandra-Worli Sea Link, Coastal Road, Mumbai Transharbour Link) have been contested by environmentalists and Kolis. Such projects severely affect coastal habitats, destroying fish breeding grounds including mangroves and wetlands, obstructing fishing boats, and interfering with inter-tidal flows crucial to ecosystem functions.

In several of the Koliwadas (e.g., Versova, Mahim, Bandra, and Worli), the construction of the Coastal Road project has

been strongly opposed by the Kolis, who have cited disruption and damage to the coastal ecologies upon which their livelihoods depend. These have created new vulnerabilities and exacerbated existing uncertainties, in a context where Koli communities have been unable to pursue legal petitions or otherwise resist these projects. With such schemes winning support from national and global funding agencies, risks highlighted by scientists and environmentalists have been ignored or downplayed, with state agencies making spurious arguments about their sustainability and climate benefits.

Cascading Uncertainties in Coastal Mumbai

COVID-19 led to severe lockdown-related restrictions on fishing, fish processing and fish marketing. In Mumbai and Maharashtra, male fishers and women were both badly affected. Typically involved in fish processing and marketing, Koli women have historically had much greater financial control and autonomy, and the pandemic substantially impacted their roles within households. In addition to the loss of fishery income, the Kolis also faced severe damage to boats and jetties and substantial reduction in the number of fishing days following the Tauktae and Nisarga cyclones. With fishing villages under extended lockdowns, work on infrastructure projects proceeded apace, encroaching on the coastal wetland habitats that Koli women and children used for creek fishing and mangrove foraging. At the same time, restrictions on movement and economic activity removed additional sources of income for those villagers working in Mumbai's informal economy.

When India's national lockdown was imposed in March 2020, the Koli villages of Versova, Worli, and Cuffe Parade were still reeling from damage to their boats and jetties caused by cyclone Maha, which struck India's west coast in October 2019. Pollution, encroachments from infrastructure and real estate projects, and commercial trawling had depleted fish stocks, damaging their livelihoods. For several months, fishers in the Mumbai Metropolitan Region had been protesting coastal transportation and infrastructure projects, which threatened to further marginalise them. They were yet to receive state-provided compensation for damage from Cyclone Maha, while diesel subsidies had been delayed by several months due to an ongoing political crisis in Maharashtra's state government. The Kolis believed they could ride out the pandemic by limiting their interaction with land-based communities, while maintaining their own food security through marine fishing. However, the first lockdown imposed new restrictions on all movement, both on land and at sea. Lacking savings or social security, the Kolis initially tried to break the lockdown restrictions in Koliwadas like Worli, triggering the imposition of a police-led containment zone, including physical barricades. This was in place for several months, despite little evidence of positive COVID-19 cases in Worli and other Koliwadas. In the meantime, the June-August annual monsoon fishing ban continued with no exemptions, such that even a loosening of lockdown restrictions could not be used to resume fishing.

A fisher from Worli complained "without any testing, the BMC (the Greater Mumbai Municipal Corporation) and the authorities said there were a large number of cases and imposed a strict lockdown. We were neither allowed to go into the sea for fishing, nor into the city for purchase of provisions for food". Another fisher leader mentioned that despite a plea to the state government to postpone the monsoon fishing ban, as compensation for the weeks lost during lockdown, this request was not heeded, further affecting the Kolis' income and food security.

A fisher from Versova Kolivada told us that many Kolis had left fishing, with only a quarter from their fishing village continuing. They blamed this on the lockdowns and other pandemic-related factors, as well as ongoing infrastructure projects. The increasing frequency of cyclones made life harder. After the central government relaxed Coastal Zone Regulation norms, the creek became a dumping ground for the construction industry. A lot of building work has taken place along the coast, reducing mangrove cover, and affecting spawning, leading to a decline in the number of fish.

Likely amplified by rising sea surface temperatures, cyclones Nisarga in June 2020 and Tauktae in May 2021 caused further damage to Koli fishing villages, housing, boats, and infrastructure. Offshore oil companies' lack of preparedness resulted in significant damage to their ships, barges and tankers, a loss of life numbering in the hundreds, and extensive oil spills. These affected fish species in the fishing grounds close to Mumbai and prevented fishing activities for many months, with many Koli villages still affected.

These cascading events and hazards—natural and anthropogenic—resulted in a steep decline in fishers' wellbeing, particularly among Koli women who traditionally controlled household finances through their involvement in fish processing and marketing. Women depleted what little savings they had (Soni, 2021), and men were forced to migrate to work in the urban informal sector, even as the state delayed or denied compensation for cyclone damage.

Political Power and Koli Marginalisation

Kolis have been among the most vociferous and litigious actors in contesting violations of the Coastal Regulation Zone norms (Chouhan et al., 2016). Together with environmental activists, they have reversed these violations and delayed construction, even if they could not always prevent coastal infrastructure and urban development projects. These developments have destroyed vast swathes of Mumbai's coastal ecosystems, especially its wetlands and mangroves, which provide food, habitats, and breeding grounds for fish and crustaceans. The lockdown provided an opportunity for the state to circumvent resistance to these projects, which construction continuing even amid restrictions on work and mobility.

During the lockdown, Koli fishers across the Mumbai Metropolitan Region have complained about increasing police surveillance of their movements and new restrictions on cultural and religious activities. The Kolis in Worli argue that the declaration of their locality as a containment zone was unjustified, with little or no evidence of community transmission.

These moves seem to have been motivated by a desire to pre-empt any Koli protests or mobilisation against infrastructure projects, and the multiple deprivations, risks, and vulnerabilities to which the fishers are exposed (Interview: October 2021). The ruling Shiv Sena party's provision of limited and partial food relief, in partnership with a major international infrastructure and mining company, only added to these suspicions. An example of care as distribution, this state government relief often has treated marginalised groups as as passive recipients of support, inhibiting their agency (cf. Gómez Becerra and Muneri-Wangari, 2021).

With support from government agencies, foreign consultants, contractors, and funding agencies, work continued on projects such as offshore oil drilling and the Coastal Road. In one case in Worli Koliwada, Koli informants have informed us that work resumed in mid-2020, despite a stay order from the local High Court citing clear illegality in obtaining permission for the coastal road project. The lockdown restrictions made it difficult for the Kolis to mobilise, organise protests or seek remedy through the judicial system—eventually resorting to a blockade of the project, on land and sea, as restrictions eased from October 2021. This was also the case in other Koliwadas, such as the Cuffe Parade Koliwada in South Mumbai. Oil drilling, the Transharbour Link, Shivaji Memorial project, new cruise ship terminals, and encroachment on the commons for parks and residential development proceeded, even as fishers were prevented from using their boats or engaging in informal street vending for survival.

These events lead us to critiques of urban political ecology and "methodological cityism" (Angelo and Wachsmuth, 2014), which advocate for the need to research processes of urbanisation, dissolving the distinctions between urban-rural and society-nature, and question the concept of the urban, rather than focusing solely on the political ecology of the city. They point us towards alternative conceptualisations of neoliberalism and "neoliberal natures", as "political doctrine, as economic project, as regulatory practise, or as process of governmentalization." (Bakker, 2010, p. 715)

In further marginalising Koli communities, this neoliberalisation of coastal resource commons prompted collective action—not just opposition to coastal infrastructure and urban development projects, but also new civic initiatives to cope with the most severe effects of the pandemic and lockdown.

Responding to the Lockdown: Civic Politics and Civic Epistemology

Even before the lockdown, ongoing marginalisation, long-running protests, and natural disasters had already diminished the Kolis' capacity to cope with the pandemic and sudden stoppage of livelihood activities. India's first lockdown was imposed suddenly, giving little opportunity for people to prepare or return home. With the government failing in its responsibility to support the poor and vulnerable, the Kolis—like millions of other Indians—experienced a loss of earning opportunities, and had to stock up on basic supplies with the aim of riding out the lockdown.

But the Kolis also revealed a more humane face of pandemic management. Pooling the little resources they had, they were able to collectively address the basic needs of food and shelter for several months when they were unable to go out to sea to catch fish. Using their knowledge of the city, and building on their existing networks, they collectively self-mobilised to meet the needs of the most vulnerable (Parthasarathy, 2020; Soni, 2021).

The Kolis' civic epistemology (Jasanoff, 2011) was reflected in the networks they were able to access, the ways they mobilised resources without state support, and the logistics they put in place to deliver relief (Kamath et al., 2020; Kundu, 2020; Parthasarathy, 2020). Youths from Mumbai's Koliwadas mobilised kinship, caste, and village networks to identify and distribute relief supplies during the first lockdown from March 2020, when almost the entire Indian population found it difficult to access basic provisions, especially goods related to food, medicines, and sanitation. Within 3–4 weeks they were able to open local clinics, with safety protocols in place. Some managed to produce, procure, and distribute sanitation and hygiene products, including masks, hand sanitiser, and sanitary pads. Coordinating with municipal and police officials to minimise barriers to movement, their distribution of goods followed safety norms with physical distancing and sanitation practises strictly enforced. Responding to the state's "displacement of care to the private space" during the lockdown (Gómez Becerra and Muneri-Wangari, 2021, p. 3), the Kolis' ability to coordinate support among local bureaucrats, civil society, and community leaders revealed a more empathetic and reciprocal sense of care, apparent at the neighbourhood level.

Once the immediate needs of Mumbai's Koliwadas were met, the youth began to coordinate with, obtain data from, and organise supplies for fishing villages in neighbouring districts, such as Palghar, where they had kin and caste group connexions. While the state and rest of civil society either neglected the needs of migrants or denied their existence, the Kolis fed, clothed, and housed other fish workers throughout the lockdown, until they could return to their villages. The Kolis' attention to the needs of migrant labour in the small scale fisheries sectors is particularly noteworthy, constituting an example of care as a practise of reciprocity. Support for migrant workers was inclusive and collectivised, fostering stronger social ties that also benefitted the Kolis, who sought to "maintain, continue, and repair" their "world" on a long-term basis (Gómez Becerra and Muneri-Wangari, 2021, p. 4).

The Kolis thus exhibit an alternate, more compassionate civil politics oriented founded on a civic ideal that values labour relations, the need to ensure food security, and the imperative to support those least able to fend for themselves during a pandemic, including the elderly, the disabled, children, women, and the poor. This civic action was ironically rooted in a larger, historical experience of collective environmental management, ensuring social security within their communities, and sustaining socio-ecological relations built around sustainable, small-scale fisheries livelihoods. These actions were built around a civic epistemology that drew upon the Kolis' customary knowledge of spaces, routes, and village demographics. They supplemented their existing knowledge by conducting surveys to organise

supply logistics, assess needs for food, sanitation, water, and medicines, and coordinate with academic researchers and activists, where needed, to reach out to donors, suppliers, and solution providers. These efforts to remain resilient and ramp up relief made each Koliwada an "urban observatory," collecting, analysing, and presenting data to support planning and interventions that could address the pandemic's impact on lives and livelihoods (Acuto et al., 2021, p. 3).

Within the Koliwadas, women played a vital role in mobilising and organising food resources, setting up community kitchens, cooking, and building networks that came to constitute informal social safety nets (Soni, 2021). In an interview in October 2021, a senior Koli woman cited the role of community networks in providing fish for vending, with supplies coming both from neighbouring districts and more distant fishing villages in the city. When some boats could not operate, women vendors bought fish from non-family members. As she explained:

> "During lockdown fishing was not allowed in Versova so we got it from other places outside Mumbai, e.g., Alibaug. All the women pooled in resources to get the fish. Even though this was illegal, we had to do it to keep us going. Why didn't the government help us? Corona came to us, but did it come to the fish? It's just been awful what has happened to us fishing communities. During the pandemic, the state is also interfering with our market halls and trying to take these spaces away, which will be disastrous for us women who play a major role in selling the fish."

In her documentation of community kitchens set up by the urban poor in Mumbai's informal settlements, Kundu (2020) claims such acts represent a reimagination of feminist labour, shoring up community level infrastructure, and recognising its contribution to collective responsibility in times of crisis. In the case of the Kolis, the villages' relative internal homogeneity, customary practises of resource and spatial governance, and control over their territories differentiated their coping strategies from those seen in informal settlements, which relied on local party leaders to access relief from state politicians and private NGOs (Auerbach and Thachil, 2021).

DISCUSSION AND CONCLUSIONS

This paper has focused on how existing inequalities and compounded uncertainties have exacerbated poverty and the vulnerabilities of India's marginalised social groups during the COVID-19 pandemic. In both the first and second waves, the state was unprepared and hubristic, leading to a significant loss of lives and livelihoods. The pandemic has also been politicised, with the central government clamping down on human rights, including the right to dissent and free speech. The compounded uncertainties described in this paper magnified the vulnerabilities of poor and marginalised people, with impacts differentiated across class, caste, race, and ethnic lines. Narrow, top-down framings of the pandemic and disaster response prevented action to address the structural causes of vulnerability and injustice that left poor people to bear the brunt of these cascades.

In Mumbai, the political ecology of COVID-19 shows the state's opportunistic use of the pandemic, in close collaboration with capital, to push through environmentally and socially damaging projects which marginalise commons-dependent fishers. Far from enhancing the resilience of the urban poor by providing relief and food security, the state authorities often exacerbated the impact of the pandemic and lockdown. As demonstrated by ongoing protests (physical occupation on land and in the sea by fishers and their boats since October 2021) against the coastal road project, the state has taken a hardened position towards the Kolis and the Koliwadas while continuing with destructive projects, and this has been the case since the beginning of the pandemic.

In contrast, the Kolis' own response reflects an incipient pathway to more equitable and caring civic strategies that, if responsibly incorporated into disaster risk mitigation governance, can help move towards a transformative strategy that helps challenge the status quo and realign power relations. For this, however, we need to understand the civic epistemologies that enabled the Kolis to efficiently address problems of logistics and distribution mechanisms, while identifying the most vulnerable in a time of crisis (Nussbaum, 2007). This emphasises the need for knowledge co-production and hybrid knowledge, a key component of the TAPESTRY project (Mehta et al., 2021). Such civic strategies were also reflected in the relatively efficient way in which Mumbai contained the pandemic during the second wave. In the large informal settlement of Dharavi, municipal actors, charitable private hospitals, local community organisations, and corporate social responsibility actors came together under the leadership of autonomous and empowered municipal commissioners. As Prakash and Rege (Forthcoming) show, a range of factors, including the willingness of the state government to delegate authority to mid-level municipal officials, legal provisions enabling the takeover of private hospitals, a history of civil society mobilisation in informal settlements, and private sector philanthropy, all contributed to Mumbai's relative success in tackling the pandemic.

In Kutch, in the first phase of the pandemic, the remote rural location meant that infection rates were relatively low. Nevertheless, the mobility of pastoralists was severely curtailed, cutting them off from essential food and medical supplies. Many rural residents survived by falling back on subsistence production, mutual aid, and solidarity networks that predated the market-based relations now seen in Kutch. Although milk supply chains were suspended, milk was consumed locally or distributed within the village. Similarly, farmers provided food aid where possible to stranded migrant workers. These moral economies, although transient and sporadic, demonstrate the ethic of care and solidarity that emerged during the lockdown. In the second wave, Kutch, like other remote areas, was badly affected. But unlike Maharashtra, Gujarat's state government had been underreporting cases, infections, and deaths, so when the second wave hit, people were largely unprepared. Infrastructure projects were supported throughout the pandemic, despite strong protests from local farming and fishing communities. This resulted in the increased securitisation of the coast, creating further challenges for Jat herders, and restricting their mobility.

Facing future events amplified by climate change, government agencies and organisations will need to develop new plans for preparedness, tailored to better accommodate regional contexts and local populations' existing vulnerabilities. In confronting compounded uncertainties, there is a need to include diverse actors, and reflect perspectives from different disciplines and global, regional, and local scales. As an example, our research on climate uncertainties in marginal environments shows how bottom-up initiatives—building on partnerships between local communities (farmers, fishers, and pastoralists), NGOs and academics—can address climate-induced livelihood uncertainties whilst engaging with issues of social justice, agency, and empowerment (Mehta et al., 2021). We argue that compounded effects of climate and pandemic related uncertainties may undermine existing solidarities and co-produce new ones. These new solidarities offer promise for thinking about potential transformative pathways to sustainability, equity, and justice at the margins. How can we nurture and sustain these "bright spots" of solidarity?

At the time of writing, 52% of Indians have been fully vaccinated with the longer-term impacts of the Omicron variant still unclear. The pandemic has caused severe economic distress in India, setting back progress on poverty reduction and efforts to achieve the Sustainable Development Goals (Bhatt et al., 2021). To relieve the distress and suffering of marginalised and vulnerable groups, opportunities for robust livelihoods recovery need to be found and should be linked with the Mahatma Gandhi National Rural Employment Guarantee Act, which has helped lift people out of poverty in the past. It is also important to improve social safety nets, especially for those whose livelihoods depend on natural resources, including fishers, pastoralists, and farmers. These groups require need guaranteed social protection in terms of food (especially for children) and universal basic income (Venkataramakrishnan, 2020; Bhatt et al., 2021).

The Indian state (especially at the Centre) has showed a lack of capacity and willingness to cooperate with civil society organisations—but it is the actions of local community groups, social movements, and civil society actors that have provided relief and welfare to vulnerable groups. There have been remarkable storeys of solidarity, the pooling of resources and food supplies, and inspiring conversations and dialogues seeking to reimagine India's future to address the failures witnessed during the national lockdowns and their aftermath. It is these bottom-up visions, solidarities, and civic epistemologies that planners and policymakers should be seeking out as resources to address the aftermath of COVID-19, through recovery and beyond. Where the central government has clamped down on civil society action, further outbreaks and future pandemics will require governance systems to be made more transparent, accountable, and open to engaging with humanitarian and development organisations.

COVID-19 is a reminder of our uncertain world and future. Indeed, these uncertainties are multiple and compounded, requiring flexibility, iteration, and adaptive learning (Leach et al., 2021). They indicate a need to push for greater equality and solidarity, both within and across countries. COVID-19 responses need to consider not just epidemiological and public health issues, but also how to address food and livelihood insecurities of vulnerable populations when these intersect with seasonal uncertainties and variability. The voices and experiences of marginalised groups need to shape government preparedness. Plural, more radical and justice-oriented approaches to preparedness may help us embrace uncertainty, instead of enforcing controlling visions that restrict creativity, while undermining rights and democratic values in the name of "unknowns" (Srivastava et al., 2020).

For us personally, as (feminist) political ecology researchers, the pandemic has also required us to look critically at our own "interconnected vulnerabilities" and conventional ways of approaching and conducting research (Gonda et al., 2021). Those of us outside India were unable to visit sites and places we know and love for about 2 years. We were worried and anxious about the health and wellbeing of local people and colleagues we have known for a long time, wondering how they were coping with the ongoing uncertainties and crises which led us to seek ways to extend solidarity and care from a distance. In writing this paper, we had to fall back on remote interviews and digital ethnography with these communities, drawing on long-standing relationships and previous insights. As Gonda et al. (2021) argue, this also meant looking at our own uncertainties and vulnerabilities due to the inability to be physically present in the field with communities and research partners we would normally work with, and being aware of role of emotion, affect, care and solidarities in our own research networks.

Finally, can the ongoing crises around the pandemic be seen as an opportunity for transformation? The pandemic has laid bare problems with local and global inequalities, unequal access to public goods, and unsustainable human-nature relations. The pandemic intersected with ongoing crises of food, water, and climate, threatening already fragile livelihoods, and compounding uncertainties for vulnerable and marginalised people. COVID-19 has also highlighted the key role played by migrant workers and informal economies in propping up a capitalist system, and their neglect and invisibility in development discourses. In most countries, the responses from above have proven inadequate, arriving too late, or failing entirely. In some cases, authoritarian leaders have used the pandemic "other" and victimise minority groups, polarising society along racial, ethnic, and religious lines.

While responses from "above" have been inadequate, in many cases—as in our research sites—the pandemic has seen an outburst of local forms of mutual aid, solidarity, and civic action. There are also many examples of resilience at the local level, as demonstrated in this article, especially amongst communities that have largely relied on subsistence production. Large-scale protests have challenged racial inequality and injustices (e.g., Black Lives Matter protests in the US and Europe), calling for a fairer and more just future. COVID-19 has also highlighted the need for investment in public goods such as public health systems and the need to universalise access to water and sanitation. Historical studies of epidemics have shown how past plagues led to protest and new visions of political and societal organisation (Atwood and Williamson, 2020). Pandemic recovery efforts should build on these lessons to bring about the

systemic shifts needed to realise locally appropriate, socially just transformations to sustainability. By drawing on the knowledge and epistemologies of vulnerable communities in marginalised and fragile ecosystems, our research shows that bottom-up research, co-produced with local communities, can facilitate transformative pathways. More importantly, new forms of social solidarity have emerged during the pandemic as a response to the compounding of uncertainties, increasing communities' coping capacities and fostering knowledges for resilience that may stand them in good stead during future crises.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

AUTHOR CONTRIBUTIONS

LM wrote the first draught building on contributions from all the co-authors, developed the conceptual framework, added some text to the case studies and finalised the article. SS provided the Kutch case and read and commented on the article. DP provided most of the Mumbai text and added some sentences to the introduction and conclusions. JP authored a brief on COVID-19 and compounded uncertainties in India that this

article builds on and led in addressing reviewers' comments. All authors contributed to the article and approved the submitted version.

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