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A process-oriented approach to equitable resilience: insights from droughts in Lake Naivasha Catchment Area, Kenya

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ABSTRACT

Drought is a recurrent hazard in Lake Naivasha Catchment Area, Kenya, a centre for commercial irrigated agriculture and horticulture. Drought affects smallholder farmers, pastoralists and larger-scale agricultural enterprises differentially. We gathered qualitative data through semi-structured individual and group interviews with representatives of all Water Resource User Associations in the area, focussing on drought impacts on various actors, and the strategies they undertook to alleviate drought effects. We used an original framework combining insights from equitable resilience and environmental justice literatures to understand how absorptive, adaptive and transformative resilience capacities are distributed among different groups. Historical processes of land alienation and promotion of commercial farming have reduced pastoralists' and smallholders' access to land and financial, social and political capital, and their involvement in water governance processes, which are dominated by large-scale commercial flower farms. Thus, smallholders and pastoralists are more vulnerable to drought and less able to enact drought resilience strategies, such as establishing water storage infrastructure and fencing off water access points. The study confirms the importance of analysing how historical processes influence contemporary drought resilience capacities. This approach enhances resilience analyses in an era of climate change, with broad implications for livelihoods and business.



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East Africa has experienced severe and prolonged drought, with serious implications for people and wildlife in the region. The UN News website declared, in an article published on 26 August 2022, that drought has contributed to food insecurity and malnutrition in

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Kenya.¹ Disasters such as drought occur within social and political contexts.² Marginalised people are often more vulnerable to droughts, with more limited capacities to respond than advantaged communities, in inequitable ways.³ Still, many analyses of actors' drought resilience strategies lack cognisance of the role of social relations and power structures. Accordingly, there is a need to examine the justice and equity dimensions of drought resilience. This article will do this with reference to Lake Naivasha, Kenya.

Resilience is the capacity of a system 'to anticipate, respond, adapt, or transform in response to shocks, uncertainty, and change, especially novel systemic changes, in order to facilitate desired outcomes'.⁴ The concept evolved from roots in engineering and ecology disciplines to acknowledge that systems combine social and ecological components, and understanding their resilience requires analysis of power relations, cultures and history, among other social and humanities concepts. Equitable resilience scholarship thus emerged to address the need for such social context in resilience studies.⁵ Equitable resilience is defined as a 'form of resilience which is increasingly likely when resilience practice takes into account issues of social vulnerability and differential access to power, knowledge, and resources' and is the focus of a standalone literature within resilience studies.⁶

To consider social differentiation, empirical works on equitable resilience have sometimes applied conceptual tools developed within the environmental justice literature pioneered by Schlosberg⁷ (i.e. 'Schlosberg, 'Environmental Justice'.) which documents how broader socio-economic, political, historical, cultural and environmental processes shape unequal socio-environmental impacts across a society at a given locality. Both environmental justice and equitable resilience approaches analyse differential impacts or capacities to manage changes at the local level. Yet, environmental justice literature poses that such localised cases should be viewed as part of broader processes.⁸ This implies that equitable resilience literature should focus on how injustices and inequities are politically and socially constructed within those systems over time.⁹

Lake Naivasha Catchment Area (LNCA hereafter) is one of Kenya's commercial horticultural hubs. Traditionally known as a water-abundant area, it hosts many successful agri-businesses. Yet, the 2019 and 2021/2022 droughts have led Lake Naivasha to drop to a level not seen since the 1940s.¹⁰ This has differential impacts on commercial and small-holder farmers and pastoralist communities – groups with differential experiences of historical processes related to land and water access and governance. LNCA is therefore an appropriate location to analyse equity dimensions of drought resilience, integrating consideration of how historical processes shape resilience capacities in a way rarely done in such analyses.

To achieve this, we first establish a conceptual foundation by integrating insights from equitable resilience and environmental justice literatures and then introduce the study area and methods. To operationalise our framework, we limit our analysis to distributive aspects, presenting findings on the distribution of drought impacts and resilience capacities, and we conclude by discussing how historical processes shape resilience. The paper thereby provides an original conceptual intervention into the emerging equitable resilience literature with a comprehensive account of recent injustices related to contemporary drought in Kenya, labelled as an 'unprecedented humanitarian catastrophe' by international organisations.¹¹

Conceptualising equitable resilience through environmental justice

Resilience is often defined as comprising three capacities. Absorptive capacity enables people and systems to buffer or resist the immediate effects of shocks using existing mechanisms and livelihood strategies.¹² Adaptive capacity is the ability to make incremental changes in ‘anticipation of or in response to change’, such as adopting new livelihood activities to ‘continue functioning without major qualitative changes in function or structural identity’.¹³ Transformative capacity is defined as:

The capacity to fundamentally change the interlinked ecological, economic, or social processes and structures that lead to undesirable outcomes, often requiring deep changes in structures and power imbalances that are rooted in culture and expressed through policies, management, and social practices.¹⁴

These capacities interact e.g. adaptive capacity may develop over time in response to repeated shocks as actors are decreasingly able to absorb shock impacts. Actors use resources or assets to operationalise their capacities.¹⁵ To internalise normative concerns about justice, analyses must acknowledge the inequitable distribution of these capacities and resources across system levels and components, due to imbalanced power relations.¹⁶ Trade-offs between the priorities of different groups, and over time and scale, are inherent – for example, when absorptive capacity comes at the expense of adaptive capacity.¹⁷ Thus, it is questioned whether systems that are inequitable at any scale can be termed resilient over the longer term and larger scale.¹⁸ Similarly, it is considered that the resilience of all subgroups and individuals should be strengthened to some extent for a group or system to be termed resilient, implying a normative definition of resilience with equity at its centre.¹⁹ This emerging literature also presents a notion of resilience as a process of negotiation between diverse groups with different priorities.²⁰ Although not the focus of this article, this includes attention to more-than-human equity, underscoring the centrality of relations between humans and ecology in debates on equitable resilience.²¹

To internalise consideration of these trade-offs and potential inequities, equitable resilience literature calls for extending resilience analyses across temporal and spatial scales, communities and sectors, because actions and norms enacted at one scale have positive or negative effects on the resilience of components at other scales.²² Thus, Stringer’s framework for analysing equitable resilience demonstrates why analysts need to ‘[t]raverse scales ... , sectors, stakeholders, and ways of knowing ... ’.²³ Similarly, any examination of a household must understand its sub-components as well as contextualising it in histories and multi-scalar effects that inequitably distribute goods and burdens as well as resources between actors.²⁴ The intersectional nature of individuals’ identities means that the differential resilience of various groups interacts with the differential resilience of individuals within those groups. Thus, though our primary unit of analysis is the social group, we acknowledge the resilience of individuals and businesses, to the extent that data indicate each is significant.

Equitable resilience literature points out that resilience is not only conferred by inequitably distributed assets. Even the way resilience is defined can engender inequity if the perceptions of marginalised and vulnerable groups remain unrecognised. If such groups are excluded from mainstream decision-making processes where their views

could gain exposure, the versions of resilience promoted in strategy, policy and implementation may disadvantage them.²⁵ The ideas of, and effects on, those at smaller spatial scales and with weaker voices, including non-human components of nature, are often ignored. Thus, actions and initiatives seeking to enhance resilience often exclude the most marginalised and may even actively reduce their resilience capacities.²⁶ The most vulnerable are often the least resilient, as vulnerabilities ‘make ... [certain] communities less resilient to shocks of all types, including well-intended but unjust government policies and practices’.²⁷

Several studies use environmental justice literature to understand equity dimensions of resilience. From the 1980s to the 2000s, the environmental justice concept was predominantly used to investigate the distribution of waste and pollution across the US at the expense of racial minorities.²⁸ Since the mid-2000s, it has been used to address global environmental issues beyond waste and pollution. Schlosberg’s widely applied framework theorises environmental justice as being comprised of distributional, recognitional and procedural justice.²⁹ These address how environmental burdens and benefits are distributed across a society, participation in environmental decision-making processes, and how far the needs of groups characterised by race, gender, income, etc. are addressed or how those groups are affected by environmental shocks.³⁰

Some environmental justice approaches have been criticised for being too localised at contemporary spatial and temporal scales. To address this, Walker’s environmental justice framework incorporates examination of social, economic, political, cultural and ecological processes leading to environmental inequalities, enabling explanations of the root causes of such inequalities across space and time.³¹

Environmental justice and resilience analyses complement each other not only in their shared focus on justice and equity, but also in their reference to vulnerability. A contested concept, vulnerability is not the opposite of resilience, but can be defined as ‘the propensity to be harmed, in this case by a hazard, and to be unable to deal with that harm alongside the social processes creating and maintaining that propensity’, and ‘the characteristics of a person or group and their situation that influence their capacity to anticipate, cope with, resist and recover from the impact of a natural hazard’, dependent on factors such as ‘occupation, caste, ethnicity, gender, disability and health status, age and immigration status ... and the nature and extent of social networks’.³² Environmental justice analyses consider how vulnerable groups are more burdened by environmental decisions and shocks, while resilience literature argues ‘being more vulnerable can often ... mean being less resilient’, and equitable resilience identifies how people develop differentiated resilience capacities for the same systemic change.³³

Equitable resilience analyses, therefore, often mobilise concepts of distributive, recognitional, procedural, contextual and corrective justice from environmental justice literature. These are linked to analyses of equitable resilience in, for example, analyses of agroecology in Senegal, flooding in Sri Lanka, participatory mapping in urban Brazil and hurricane-induced displacements in the Bahamas.³⁴ Yet, equitable resilience analyses less often incorporate processual aspects of environmental justice. Many studies and conceptions of equitable resilience remain too localised, documenting inequities in resilience in a given system, rather than understanding the processes through which those inequities were formed and through which certain groups became more vulnerable.³⁵

Simultaneously, environmental justice studies incorporating explicit examinations of process rarely explicitly address resilience. Such work has shown the impact of processes such as colonialism, agricultural and energy modernisation, international aid politics, and global market development processes on environmentally disadvantaged groups. These include marginalised Malian Tuaregs disproportionately affected by climate change and rural Turkish populations affected by hydropower developments.³⁶ These studies broaden the scope of analysis, looking across groups, space, sectors and time to examine the processual construction of asset distributions and decision-making processes. Yet, it is less often explicitly considered how this impacts different groups' resilience capacities.

Integrating the process component of Walker's environmental justice framework into equitable resilience analyses would enable the analyst to identify the fuller historical and structural reasons certain groups have differential resilience capacities or are not recognised and therefore excluded from decision-making procedures. International trade, wars and conflicts, globalisation, modernisation, agricultural commercialisation, cultural domination and urbanisation are all examples of broader processes through which such inequalities may arise.³⁷ The integration of historical detail allows analysts to identify when differentiation in resilience capacities is unjust or inequitable, for example, where groups have differential responsibility for drivers of environmental change. Thus, Figure 1 poses in solid boxes a conceptual framework that specifies a relationship between processes, vulnerabilities and resilience, and in dotted boxes a proposition for analysing this using equitable resilience and environmental justice approaches. We will follow this approach in our analysis. (see Figure 1).

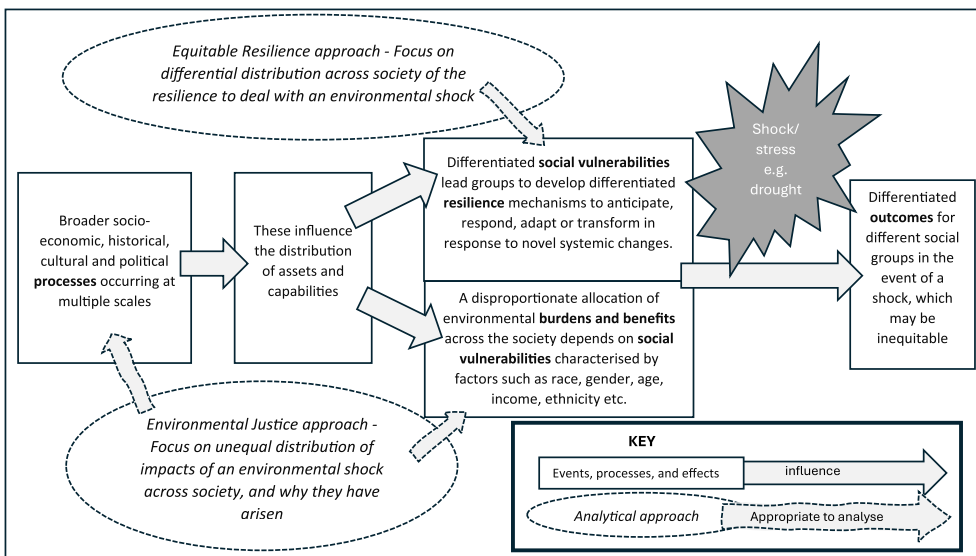


Figure 1. Process-oriented conceptual framework of environmental justice and equitable resilience following a systemic change.

Lake Naivasha Catchment Area

Lake Naivasha is Kenya's second-largest freshwater lake.³⁸ Its catchment area is located within the Eastern Rift (see Figure 2).³⁹ It receives more annual rainfall than other major lakes in Kenya: from 600 mm at the shore to 1500 mm in the upper catchment.⁴⁰

Lake Naivasha's surface area and water level fluctuate, and drought resilience should be considered in the context of resilience to these fluctuations more generally.⁴¹ The lake's surface area halved between the 1920s and 1960s, attributed to increasing human settlement in the region, declining further in the 1980s due to increased water abstraction.⁴² Between 1990 and 2022, surface area fluctuated between 90 and 140 km², reaching 21% larger than the levels seen between 1984 and 2009 by 2020, due to increased rainfall since 2010.⁴³ Recently, the lake's surface area increased dramatically, displacing thousands of people living at the lake shore, as reported by Al Jazeera on 20 November 2025.⁴⁴ Nevertheless, the catchment area suffers from recurring droughts, such as those witnessed in 1980, 1984, 1988, 2001/2002, 2005/2006, 2014/2015, 2017, 2019 and, most recently, 2021/2022, which decreased the lake surface area and is the focus of this article.

The catchment area is a popular destination for domestic migrants, as horticulture, tourism and industry provide job opportunities. The area's population is estimated at around 400,000, quadrupling between 1979 and 2009 thanks to the expansion of the cut-flower and horticulture industries.⁴⁵ Over 50 large-scale irrigated commercial

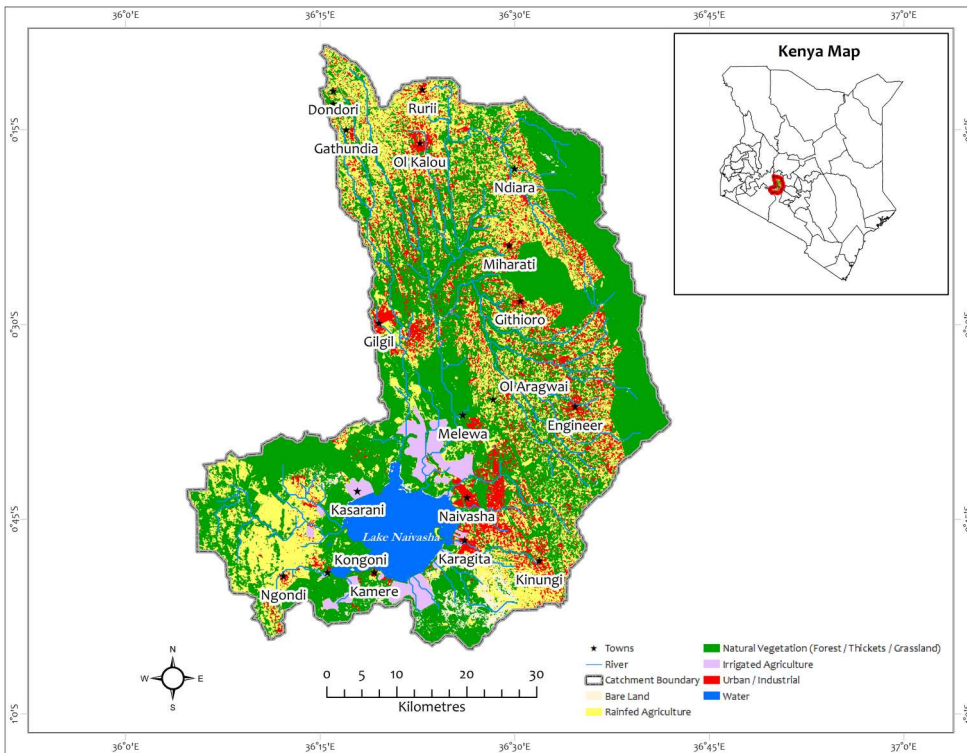


Figure 2. Map of LNCA and its landcover (Source: Global Landcover Product, commissioned by the authors, constructed by James Mumina).

farms around the lake cover an area of 4500 ha.⁴⁶ 43% of this irrigated area produces cut flowers, while the rest specialises in vegetables and fodder. That irrigated area accounts for 70% of Kenyan horticultural production.⁴⁷ There are 30,000 smallholder farms in the catchment area, mostly located in the upper zones. These farms mostly contribute to domestic horticultural production.⁴⁸ Smallholder farmers in mid- and upstream areas of the catchment rely on Malewa, Gilgil and Karati rivers for irrigation. Maasai pastoralists living across the catchment depend on those rivers alongside the lake and are heavily impacted by agricultural expansion. Historically, competition for water between smallholder and commercial farmers and pastoralist groups intensifies during droughts. Environmental justice analyses have examined labour conditions in cut-flower farms and disparities in land ownership between settlers and pastoralist groups.⁴⁹ (see [Figure 2](#))

Field methods within Kenya's water governance context

Kenya's first (1974) Water Act designated the Ministry of Water Development as Kenya's main water bureaucracy, further centralising water governance.⁵⁰ The Act promoted the construction of irrigation schemes and water supply infrastructure across the country.⁵¹ With the increasing influence of donors and international finance institutions on Kenyan politics, and inadequate funding and institutional capacity for Kenya to realise the 1974 Act's ambitions and structural adjustment policies, the Kenyan government began water governance decentralisation in the 1980s, codifying it in the country's 2002 Water Act.⁵² This gave local authorities more power to manage their water services, created the Water Resources Management Authority (WRMA) as the main water bureaucracy responsible for setting national water policies and founded the Water Resource User Associations (WRUAs).⁵³

WRUAs are 'community groups focused on the management and conservation of water resources of a particular area, river or aquifer'.⁵⁴ Their mandate is to:

assist the national ... WRMA, in its permitting decisions, and they are responsible for devising appropriate water rationing schedules during times of drought. WRUAs also act as a forum for information sharing and conflict resolution between CWP [Community Water Projects], and water conservation projects ... At regional level, WRUAs are independent, autonomous decision centers, responsible for conflict resolution and sharing water allocation authority with WRMA.⁵⁵

Empirical evidence was collected through fieldwork in the LNCA during May and June 2022. Fieldwork was heavily affected by Covid-19 restrictions, preventing us from interviewing smallholder farmers, pastoralist groups, and commercial farmers separately. Thus, acknowledging the governance structure outlined above, we designed our fieldwork to engage directly with all WRUAs in the LNCA, using purposive sampling. We designated WRUAs as the most appropriate stakeholder entry point due to their key and active role in water governance and water apportioning during drought. Interviewees included WRUA officials and committee members, including smallholder and commercial farmers and pastoralists. They were able to comment on the needs and interests of their diverse member stakeholders, including small-scale farmers, commercial horticultural farmers, cut-flower farms, hoteliers, pastoralists, and conservancies, while

detailing the challenges and opportunities they experienced during the 2019 and 2021/2022 droughts.

This study was approved by the Cranfield University Research Ethics System (Ref: CURES/12825/2021) on 5 March 2021. Informed consent was obtained verbally before participation due to the sensitivity of the topic in rural Kenya and interviewees' reluctance to sign paper consent forms associated with foreign institutions.

We interviewed officials and committee members from all 12 WRUAs. Seven interviews were group interactions involving two to five WRUA members; five were individual interviews with either the president or the vice president. WRUAs 3, 4 and 10 were also re-interviewed for further clarifications. The first round of interviews was audio recorded, translated into English (when interviews were conducted in Swahili) and transcribed by the research team. Researchers took notes during follow-up interviews. Interviewees were anonymised using pseudonyms numbered 1–12.

Interview questions to identify drought impacts and drought resilience capacities asked participants to narrate the drought history of the region, perceived changes caused by the 2019 and 2021/2022 droughts, and how people responded to them. To understand perceived inequalities embedded in developing drought resilience capacities, we asked about the role of WRUAs in water allocation, challenges and opportunities in developing drought responses by different actors in the region, policies in place and their implementation at the district level, and the level/context of any conflicts between water users. We categorised these data into drought impacts and resilience strategies as summarised in Tables 1 and 2. Narratives provided by interviewees were deductively analysed in relation to Figure 1, alongside secondary data from literature.

Table 1. Distribution of drought impacts in the LNCA.

WRUA location	Drought Impacts
Downstream	<ul style="list-style-type: none"> • No/ less rainfall • Rivers and boreholes drying • Lake shrinkage • Water and borehole pollution • Fencing limits access to water • Water competition between users • Limited irrigation • Livestock/ wildlife death • Animals accessing and polluting water • Confusion over planting times • Lack of pasture/fodder • Bare ground • Crop failure • Plant diseases • Reduced fish population • Lack of food • Increased food and water prices • Job losses
Upstream	<ul style="list-style-type: none"> • Less water access for poorer users • Water pollution • Trees drying • Increased water and food prices • Job losses • Hunger and poverty • Decreased school enrolment

Table 2. Drought resilience mechanisms in the LNCA.

Water user group	Resilience capacities
<p>Smallholder farmers; pastoralists</p>	<p>Absorptive Capacities</p> <ul style="list-style-type: none"> • Fencing land and water • Constructing infrastructure: tanks, pipes, pans • Buying water • Abstracting without permits • Farming on the receded lake area • Logging without permits • Fishing without a permit • Vandalising pipes • Burning charcoal • Feeding animals fodder • Grazing around water sources • Spending savings • Stopping irrigation • Seeking food elsewhere <p>Adaptive Capacities</p> <ul style="list-style-type: none"> • Harvesting Water • Constructing reservoirs • Rationing water • Improving irrigation efficiency • Diversifying crops • Diversifying/ switching livelihoods <p>Transformative Capacities</p> <ul style="list-style-type: none"> • Distributing new seedlings • Adopting drought-resilient crops • Planting trees; conservation activities
<p>Commercial farmers; upstream smallholders</p>	<p>Absorptive Capacities</p> <ul style="list-style-type: none"> • Abstracting without permits • Increasing abstraction • Purchasing/ conveying water from elsewhere • Constructing infrastructure: tanks, pipes • Drilling new boreholes • Grazing around water sources • Ceasing irrigation; prioritising domestic use • Burning charcoal • Felling trees <p>Adaptive Capacities</p> <ul style="list-style-type: none"> • Harvesting water • Rationing water • Switching crops • Reducing dairy production; increasing prices <p>Transformative Capacities</p> <ul style="list-style-type: none"> • Distributing new seedlings • Adopting drought-resilient crops • Planting trees; conservation activities

Drought impacts, drought resilience and (in)justices in the LNCA with a distributive focus

Unequal distribution of drought impacts

The 2021/2 drought put greater burdens on smallholder farmers and pastoralist groups within the LNCA. Geographical position was key in determining who was most affected.

Downstream smallholder water users identified greater impacts on livelihoods and food availability than upstream users (Table 1).

The most common drought impact raised by all interviewees was, unsurprisingly, decreasing water availability. They referred to a lack of/less rainfall, completely dry streams, or water shortages. Yet, downstream smallholder farmers described severe drought, with words like ‘complete drying’ or ‘no water’, while upstream users described a less extreme situation. For example, one WRUA representative stated that drought ‘is there, but not severe since we are in the upper catchment’.⁵⁶ Similarly, another WRUA indicated that their site was not heavily affected, as their upstream location enabled them to access water instantly and abstract more.⁵⁷ Smallholder farmers located downstream named poor water access as a major impact; upstream users described this issue merely as something they ‘know’ to affect downstream users.

Downstream interviewees indicated declining water levels increased competition for water between different users and escalated social unrest in certain places. Three interviews illustrated a common perception: that flower farms, the military and other commercial users such as hotels abstracted more than they did by fencing off land adjacent to the river and lakewater or diverting water. In the absence of empirical evidence for such abstraction, this illustrates the sense of injustice felt by those with worse water access, who attribute disparities in water access to direct alienation by those with better access.

Drought exacerbated hunger, poverty and unemployment.⁵⁸ Agriculture and horticulture are the main livelihoods for LNCA residents, who are either pastoralists, practise subsistence agriculture and sell excess in local markets, or are employed by agrobusinesses. All downstream smallholder interviewees noted that impacts negatively affected livelihoods through higher food and water prices and food shortages.

Comments about on-farm livelihoods showed how drought interacted with existing financial vulnerabilities:

Farmers invest in irrigation through loans, but [because of] shortage of water, they end up with crop failures ... and cannot afford to [repay] the loan.

[After naming several distributive impacts presented in Table 1] This year is terrible; nothing is happening. I have a permit to do irrigation, but I have no capital [to practise it] ... Animals lack fodder and [we buy fodder] from other places [which] has become very expensive.

We depend so much on onion farming. The seed to produce onions is costly, about KSH 30000. When it is dry, the seedlings die in nursery, which is a significant loss.⁵⁹

Others showed that wage labourers were also affected: ‘Work is available when it rains, but as soon as drought [hits] crops, there is reduced labour, and therefore, no wages’.⁶⁰

Upstream water users also mentioned similar problems, but their portrayal ranged from scepticism about droughts to glorifying them. For example, one WRUA explained that ‘shortage of food, water and pasture [led] to buying of everything such as food like onions, cabbages ... the things we are not used to [buying]. Even water is bought! Therefore, money gets depleted very fast and poverty looms’.⁶¹ They further argued that such problems pushed families to prioritise access to food over other things like children’s school education: ‘you will find school enrolment is reduced due to the money for

school fees used to purchase food'.⁶² In a contrasting statement, one WRUA, operating at the closest point to the river source, indicated that a lack of food is 'not so much' in the region, maintaining 'if someone has no food; [it means] they are lazy since it does not dry so much [here]'.⁶³ This interviewee claimed upstream residents made more money during droughts, as their dairy production decreased, but the demand was high, so they could sell their limited products at higher prices: 'Drought is a blessing in this area since it does not dry to the point of lacking food. The food prices are high ... they can sell. When it is dry, people here have money'.⁶⁴ (see Table 1).

Distribution of resilience capacities

A specific action may represent adaptive capacity for one actor and absorptive capacity for another.⁶⁵ Table 2 shows the uneven distribution of absorptive, adaptive and transformative drought responses. These categories were derived inductively from interview data, based on respondents' descriptions of their actions and intentions (see Table 2).

(Un)equal distribution of absorptive capacities

All interviewees confirmed the LNCA had periodically been affected by severe droughts. Many described mechanisms they used continually or periodically to continue their existing livelihoods whenever drought occurred. These included fencing, constructing and purchasing water access and storage infrastructure, farming on contested land and doing petty crime. The literature shows Kenyan pastoralists have absorbed effects of drought by migrating, changing herd composition and size, restricting food and water intake and changing household composition, e.g. through fostering.⁶⁶ These are not shown in Table 2 as movement restrictions prevented us from collecting primary data on them, but it is reasonable to suppose pastoralists around Naivasha follow the same strategies. Those with more capital, e.g. commercial and upstream farmers, had the capacity to absorb drought impacts and continue pursuing the same livelihood activities.

Two WRUAs indicated that flower farms immediately fenced their private farmland to deal with drought, limiting smallholder/subsistence farmers' and pastoralists' access: 'Fencing from a flower farm in or around the lake causes conflicts and blocks pastoralists from accessing the water and pasture'.⁶⁷

Farmers attempted to construct water infrastructure to store water and maintain irrigation, enabling actors to continue agricultural livelihood activities. Richer water users could reportedly do this easily. For example, one WRUA explained: 'some flower farms have built reservoirs, harvested water from their rooftops and greenhouses, and pumped water from the lake to blend it, [and] ... boreholes are dug'.⁶⁸ Similarly, flower farms were reported to 'harvest water in dams from [their] greenhouse rooms', while 'the community is also trying to do water harvesting through water pans'.⁶⁹ One WRUA indicated:

People in upper zones have boreholes and [boreholes] have been used during water shortage. Water harvesting, boreholes help in the order of the day ... We are used to the problem ... , therefore we have boreholes and people learn to get water from [their] usage. Some have tanks and other means of storing water.⁷⁰

In addition to such individual and farm-level infrastructural responses, in some cases (local) government and international NGOs improved water infrastructure in some areas of the catchment. For example, one WRUA stated that ‘recently water [was] brought, piped water through the county government ... [and] the government concluded water pan construction’.⁷¹ In another site, ‘Greenbelt [Initiative] offered containers for water harvesting’.⁷² Furthermore, it is reported that ‘at least now what ... the county government is doing is scoping of dams ... so that we ... [are] able to harvest runoff, store water we can use to do farming’.⁷³

However, those mechanisms were not available for every region or person. Interviewees highlighted that smallholder farmers rarely have enough financial and social capital to buy available products and comply with the country’s agricultural policies, and they are unaware of or unable to access financial support, leaving them disadvantaged in favour of existing commercial farmers. For example, one WRUA listed mechanisms like irrigation infrastructure, water pans, and runoff water harvesting as his recommendation for tackling drought, hinting that those mechanisms were not available for his region.⁷⁴ Similarly, smallholder WRUA officials in downstream sites described how government-supplied pipes and water pans were costly, as were boreholes, and in any case tended to ‘dry up at some point’.⁷⁵ Thus, they continued to depend on rain.⁷⁶

Almost all interviewees mentioned that, in periodic instances of water shortage, or when their access to water was limited by others fencing water sources off, people had historically tended to be willing to risk censure by undertaking illegal activities to maintain livelihoods, or merely to ‘survive’. Theft was mentioned in one WRUA: ‘in small towns, people try to survive, we used to have a lot of chicken theft because they have nothing to do’.⁷⁷ Charcoal burning and logging without permits were frequently mentioned as livelihood mechanisms used to manage during drought, in all zones: ‘Charcoal burning is illegal. It is not allowed, but people do it’.⁷⁸

One WRUA complained: ‘Charcoal burning is not there since we have no trees [in the area]’, highlighting the level of desperation there. Conversely, two WRUAs reported that the electrical fence around the forest prevented people from charcoal burning.⁷⁹ One of these interviewees noted that despite the electrical fence, ‘we do not lack criminals, which means we have illegal activities [like logging] around the forest’.⁸⁰

During drought, many farmers risked contestation by farming and grazing on land that was claimed by others. One WRUA confirmed our observation that smallholder and subsistence farmers who had lost water access cultivated on land that did not belong to them where lakewater had receded, saying ‘small-scale farmers cultivate where papyrus dried’.⁸¹ In the same area, we witnessed broken fences around private and/or deserted properties on the lakeshore, with our interviewee stating they were broken by subsistence farmers to gain instant access to water or by pastoralists for grazing their livestock. A WRUA representative mentioned ‘farmers ... bring [goats] to the banks of the dam areas where trees have been planted ... [politicians] allow people to graze [at those areas despite being illegal] ... to garner votes’.⁸²

Some WRUAs claimed smallholder/subsistence farmers and pastoralists used criminal vandalism to access water: one WRUA stated the ‘community goes and destroy [flower farms] pipes’.⁸³ Another claimed people resorted to ‘vandalism of water pipes to divert water to their farms’.⁸⁴

Thus, livelihoods are organised to absorb the immediate impacts of recurrent droughts. People's livelihoods include various strategies developed during past droughts, which they use to allow them to continue a particular livelihood trajectory without needing to adapt extensively.

(Un)equal distribution of adaptive capacities

Not all responses involved accessing more water – rather, some attempted to reduce water demand. Adaptive capacities (Table 2) included efforts to switch to new business ventures, diversify crops and livelihoods, and ration water. They are not developed by everyone to the same degree; therefore, their distribution also reveals justice and equity issues. Several required longer-term planning, showing the need for some degree of anticipatory ability.

When drought hit, people resorted to new business ventures, for example, 'small-scale farmers venture into other areas, because [farming] is not sustainable'.⁸⁵ Two WRUAs highlighted that when smallholder/subsistence farmers were unable to practise agriculture independently, they began wage labouring at commercial farms, which could afford better water access.⁸⁶ Pastoralist communities were reported to switch to 'agro-pastoralism ... since the area for grazing is reducing'.⁸⁷ Hiring motorbikes to fetch water to sell within the community has become an important alternative to farming.⁸⁸ Construction jobs also became popular: 'The animals are dead, and those involved in irrigation have no water. Therefore, people ... have resorted to road construction jobs'.⁸⁹ Other business ventures included trading products such as charcoal and timber. This is a general rather than drought-specific adaptation strategy, which could, to some extent, buffer against the Lake's periodic flooding. However, one WRUA cautioned: '[small businesses are] not so dependable. You know the problem is that they [still] depend on farmers [and farmers do not have money]'.⁹⁰

However, not all farmers pursued this deagrarianisation pathway. Some people chose to remain in farming, diversifying their crops/livelihoods. For example, people aimed for fast-growing crops or 'short-term crops that can go for three months ... [particularly] high value fruit trees'.⁹¹ Similarly, it was claimed:

We are also told to diversify like rear poultry which is also a source of income besides crop production and can give you income within a short time and give you food ... so that one does not rely on maize which you can plant, and you will not harvest [due to lack of water].⁹²

WRUAs developed a joint water rationing plan across the catchment area, a 'kind of rotational plan', which obliged downstream WRUAs to negotiate with upstream WRUAs to release water at certain periods during the day.⁹³ Each individual user is allocated a specific timeslot to abstract water and loses their slot if they miss it.⁹⁴ Water rationing aimed to provide domestic water to households in the first instance, rather than providing irrigation water: 'particularly schools ... are given priority in the day, then at night other community users'.⁹⁵ The scheme is monitored: 'Levy is charged for abstractors and scouts are hired to control water distribution [over the watercourse]'.⁹⁶

However, water rationing plans had not drastically improved water access for people. For example, it is reported that 'even rationing does not get to many people, [as] most

people [still] fetch water from the ... river [by bypassing the plan]'.⁹⁷ Similarly, it is indicated that 'water rationing is a challenge in distributing water to 600 members', while the rationing process was called 'the hardest for WRUAs'.⁹⁸ One downstream WRUA complained that due to excessive upstream abstraction, they were unable to get enough water, even when they implemented the plan, despite efforts to strictly patrol the water abstraction in the WRUA area.⁹⁹

(Un)equal distribution of transformative capacities

It is difficult to directly observe the development of transformative capacities in the LNCA in the aftermath of recent droughts, as transformation and deep structural changes tend to occur slowly. For example, water rationing, explained above, may have little impact on current water use in the catchment area, but the processes (intense negotiations between different water users) may lead to a deep change in power relations and structures over time. However, some identified mechanisms could be considered transformative capacities, as they have already changed actors' perceptions and aim to change the hydro-ecology of the region. These are switching to drought-resilient crops and trees, and tree plantation and conservation activities.

A switch to drought-resilient crops and trees has been promoted and implemented to a limited extent in the region: '[There is a] programme to teach farmers about short-term crops and drought-resistant crops such as Katumani maize and pigeon peas'.¹⁰⁰

Tree plantation and conservation activities have been actively used by most WRUAs as a response to drought over the past decades. These activities may benefit smallholder farmers by 'creating microclimates with lower mean air temperatures and higher soil moisture ... ; reducing crop transpiration rates ... ; minimizing soil loss from water erosion ... ; enhancing soil fertility'.¹⁰¹ The region's drought history, together with the involvement of international NGOs in mitigating drought impacts, led WRUAs to encourage such activities. For example, multiple WRUAs named international NGOs and programmes, such as World Wildlife Fund (WWF), Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), Greenbelt Initiative and Gold Standard, as raising awareness of reforestation and conservation activities, training farmers and distributing seedlings.¹⁰²

Three WRUAs referred to reforestation initiatives and policies urging people to plant more trees than they cut.¹⁰³ For example, one WRUA explained that

Conservation started due to climate change and reduced rainfall. We looked at the ways how to restore our farms ... On-farm tree planting, ... long-term tree planting ... help reduce effect of strong winds.¹⁰⁴

However, these activities had not always yielded positive results, mainly because unsanctioned logging was a livelihood option some people turned to during droughts, and logged trees had not always been restored. It is also because some people prefer to plant eucalyptus, which has a commercial value but consumes a lot of water and lowers the water table.¹⁰⁵

When talking about tree planting, one WRUA cautioned that 'I hope they are not bringing eucalyptus trees'.¹⁰⁶ Farmers were observed planting eucalyptus with good

intentions, yet simultaneously complaining about dry boreholes and wells – to which those trees might have contributed.

Overall, drought impacts and absorptive, adaptive and transformative capacities were unevenly distributed between groups, and to some extent individuals within groups, based on their geographical location, wealth and land access. Downstream smallholder farmers and pastoralists experienced more negative effects of drought, which intersected with existing financial vulnerability. Wealthier water users, regardless of their location, could invest in water storage infrastructure or alternative livelihoods and technologies to help them adapt to drought. Those with access to lakeside land maintained good access. They had also been able to establish more lucrative businesses, with accumulated wealth helping them buffer drought effects. To understand the roots of these inequities, we examine the historical processes – particularly land and resource commercialisation – that have shaped resilience capacities in the LNCA.

Bringing ‘process’ into equitable resilience analyses: marginalisation of smallholder farmers and pastoralists in Kenya through commercialisation of agriculture, land and natural resources

The unequal distribution of resilience capacities observed in our primary data was shaped by historical processes. LNCA’s and Kenya’s postcolonial history involves policies of commercialisation of land, agriculture and natural resources. This systematically exacerbated smallholder farmers’ and pastoralists’ vulnerabilities, eventually leading them to bear more socio-environmental burdens during droughts and have differential resilience capacities to commercial farmers.

During Kenya’s colonial era, European settlers exclusively owned land, establishing ranches, agriculture, and tourism. The LNCA was labelled the ‘White Highlands’ in this era and designated a recreational area by white Europeans.¹⁰⁷ Maasai pastoralists were systematically displaced from their ancestral lands, preventing them from using mobility as a drought resilience strategy.¹⁰⁸

The 1954 Swynnerton Plan of the departing colonial government shaped Kenya’s postcolonial land and agricultural policies, establishing the compensated transfer of land ownership from Europeans to Africans.¹⁰⁹ Africans with more capital and farming experience could buy the most productive land to maintain cash crop production, with post-colonial policy promoting modernised commercial agriculture as the backbone of the Kenyan economy.¹¹⁰ Inexperienced farmers and smallholders ended up with more marginal lands, and the exclusion of pastoralists continued.¹¹¹ In the LNCA, many white settlers also retained their lands, while white settlers from other parts of Kenya relocated their ranches to the LNCA.¹¹² Kikuyu smallholders began to farm around the lake shores in the 1960s.¹¹³

Through the 1960s and 70s, Kenya’s agricultural and development strategies promoted smallholder involvement in cash-crop production, implementing price controls, offering commodity-specific incentives and keeping taxation relatively low.¹¹⁴ These policies increased agricultural growth while favouring commercial (and generally European) producers.

In the LNCA, the booming commercial agricultural sector included flower farms. The first, a Dutch enterprise, was invited by the then-Minister of Agriculture. The incentives

provided by the Kenyan government to attract such businesses included 'land (under low-cost, long-term lease), exclusive growing and trading rights for eight years ... , unlimited work permits for expatriate workers, and a 25-year guarantee not to change laws on foreign investor taxation and profit repatriation'.¹¹⁵ This is the foundation of the land ownership structure described in the previous section that enabled flower farms to enclose parts of their land where water can be accessed. These land dynamics and the resulting financial advantage enhanced the resilience of those businesses and their successors to drought while increasing the drought vulnerability of those who subsequently had limited access to lake water during dry periods.

These floriculture businesses were consolidated under Structural Adjustment Programs (SAPs) and linked schemes intended to tackle the economic and political problems of the 1980s and 90s. Tax breaks and discounts on water provision for larger commercial companies led to the growth and consolidation of the flower industry, while former smallholder farmers sought employment opportunities at the large-scale farms.¹¹⁶ '[T]he core of the [floriculture] industry ... was formed by just a handful of, mainly foreign-owned, large-scale farms', which, by the 2000s, were hiring thousands of smallholder farmers.¹¹⁷ Agricultural policy reform in the 2000s promoted efficiency and certification, continuing the trend.¹¹⁸

SAPs, including free market pricing, initially led to a decline in the proportion of smallholders, but their numbers increased with twenty-first century policies promoting smallholding within the commercial sector. Yet, although contemporary policies explicitly prioritise smallholders, the focus on commercial production, technological advancement and agricultural efficiency inadvertently favours commercial farmers, as the realisation of policy objectives is heavily related to having access to financial and social capital. This explains why many smallholders lack capital to engage in the infrastructural developments that enable them to absorb the effects of drought by storing water for irrigation, and periodically turn to alternative, sometimes illegal, livelihood strategies as absorptive measures.

While these changes in land and capital distribution were taking place, water governance structures also changed in the LNCA. Since the colonial period, multistakeholder platforms have shaped environmental policies and water use. Lake Naivasha Riparian Owners' Association (LNROA) was established in 1929 by landowners to ensure their property rights and access to natural resources and water.¹¹⁹ Only lakeshore landowners could join LNROA, and its main objective was to protect the recreational value of the lake. It did this by excluding smallholder farmers and pastoralist communities from water decisions, consolidating social and political capital within its members.¹²⁰ LNROA blocked several development plans in the post-colonial era and lobbied for the lake to be declared a Ramsar site. Despite becoming the Lake Naivasha Riparian Association (LNRA) in 1998 and extending membership to non-landowners, smallholder farmers and pastoralists remained largely absent from its membership.¹²¹ The LNRA's 2004 Lake Naivasha Management Plan was officially gazetted in 2015. It reflected members' interests and introduced no limitations on water abstraction.¹²² This is a main reason why flower farms can construct water infrastructure to abstract the Lake's water: their ability to take lake water for granted has been supported by longstanding water governance arrangements.

The 2002 and 2016 Water Acts delegated decentralised water management powers to WRUAs to manage water resources at their source and apportion water for irrigation at the local level. LANAWRUA was established in 2007 as an umbrella WRUA convening ‘individual water abstractors, irrigators, pastoralists, commercial users, tourist operators and water service providers, and ... the other 11 WRUAs ... who are mostly small-scale commercial farmers’ to oversee water allocation in the basin.¹²³ LANAWRUA is seen as a competitor to LNRA, with its membership being more inclusive, yet several interviewees confirmed that flower farms and other commercial users steered LANAWRUA to reflect their interests in water decisions and allocations, again diverting political capital from other actors.¹²⁴ This explains why water rationing plans are less effective for enhancing the resilience of smallholders and pastoralists. Commercial upstream water users, and flower farms at the lake shore who advantaged from postcolonial land allocations, can exert influence in existing water governance structures, enhancing their ability to continue to abstract water.

Overall, environmental burdens associated with drought were experienced more strongly by smallholder farmers and pastoralists residing in the downstream and mid-stream areas of the LNCA, despite these groups having made less contribution to environmental and climate change.¹²⁵ Furthermore, resilience capacities were disproportionately distributed, with smallholder farmers and pastoralists having fewer resources with which to manage in a drought. Historical processes of commercialisation of agriculture, land and natural resources in Kenya led to these smallholder farmers and pastoralists becoming more vulnerable to drought compared to commercial farmers, alongside less advantaged individuals in dominant groups, with these effects often mediated by age, wealth and gender.¹²⁶ This is due to their gradual and systematic alienation from land, disadvantage in terms of capital and inability to participate in water governance processes. These factors interact with geographical location, and with each other, for example, as wealthier Kenyans gained access to favourable lakeside land.

Figure 3 shows the continuity between these historical processes and contemporary inequitable resilience outcomes (see Figure 3).

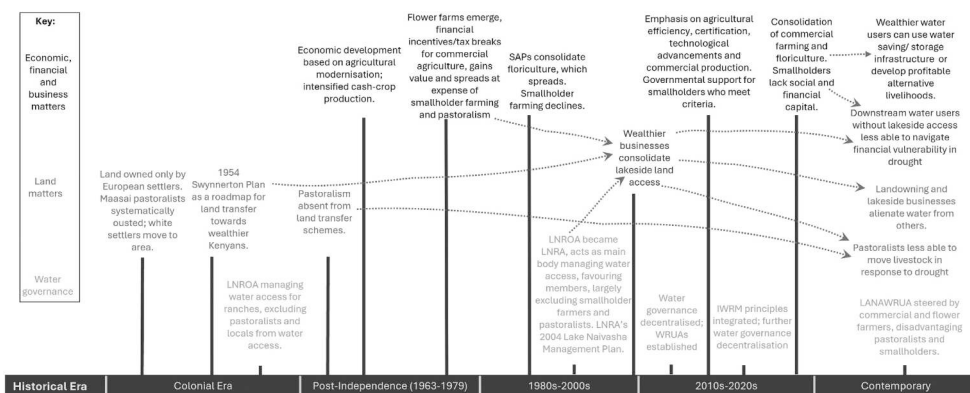


Figure 3. Timeline showing connections between historical processes and contemporary inequities in drought resilience.

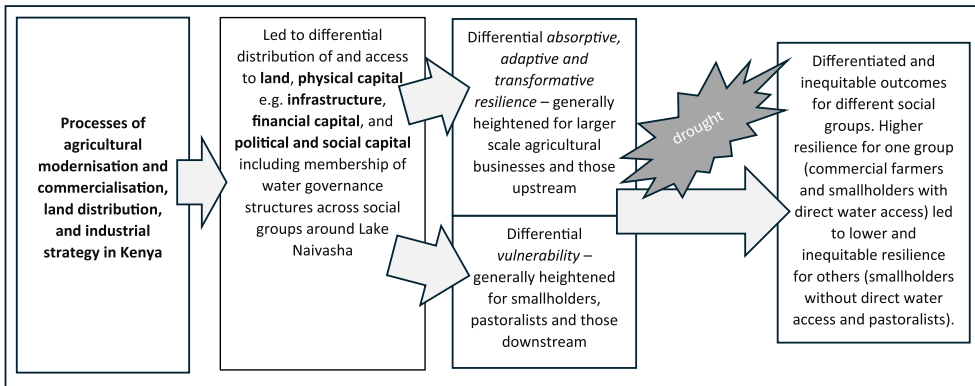


Figure 4. Application of process-oriented framework from Figure 1 to Lake Naivasha drought case study.

This disjuncture between disadvantaged actors' contribution to environmental change, their marginalisation in terms of resource access and their greater environmental burdens and lower resilience capacities makes this unequal distribution inequitable or unjust. While our analysis of contemporary resilience capacities organises them into conventional categories of adaptive, absorptive and transformative capacities, our novel contribution lies in linking these capacities to distributive justice and historical processes of marginalisation in terms of land, capital, and water governance. The application in Figure 4 of our framework illustrates how historical processes have led to inequitable resilience outcomes. We conclude by reflecting on the broader implications of integrating process into equitable resilience analyses. (see Figure 4)

Conclusion

This article moves beyond conventional analyses of equity dimensions of resilience by incorporating an understanding of 'process', as defined in environmental justice literature. Thus, we heed calls to show how post-colonial changes in land access contribute to inequitable resilience of marginalised groups over the long term, thereby enhancing social and political dimensions of equitable resilience analyses.¹²⁷

The way socio-environmental burdens and benefits and resilience capacities are disproportionately distributed across society is related to distributive, recognitional and procedural dimensions of justice. The application of the justice lens shows how differential distributions occur and how historical processes may make those differential allocations inequitable. Therefore, our framework underscores that concerns about 'environmental justice' and 'equitable resilience' must be considered integral to each other. It allows us to focus on drought impacts and drought response mechanisms simultaneously, with specific attention to justice. Smallholder farmers, marginalised groups and individuals in the LNCA face inequalities during and after drought. These result when contemporary drivers, such as the location of markets and the prevalence of drought, are exacerbated by long-term favouritisation of large-scale commercial farmers in Kenyan politics. Thus, our framework allows us to connect ongoing injustices

faced by these groups to broader historical developments shaping Kenya's agricultural politics and natural resource governance, and could similarly be applied elsewhere. The 'process' component helps trace root causes of inequalities and historicise resilience.¹²⁸ This addresses critiques of 'equitable resilience' as apolitical by explicitly guiding analysts to add a process component to their analyses.

One limitation of this research was our narrow focus on distributive aspects of our conceptual framework, mainly due to space limits. We recommend future research to integrate recognitional and procedural dimensions and to test the framework in other contexts. Another limitation is the paucity of primary data on pastoralist responses, due to Covid-19 movement limitations, leading us to strategically prioritise WRUAs as our interview sample. Though the literature contains documentation of pastoralist drought responses across Kenya, we recommend fieldwork to confirm them in the Naivasha context. The 'process' component of our framework may be improved by considering debates on 'climate coloniality/colonialism'.¹²⁹ These show how colonialism has dispossessed marginalised groups of resources, livelihoods and lives, frequently leading to climate maladaptation and further marginalisation.¹³⁰ They call for the interpretation of contemporary marginalisation within broader, power-laden, historical and political processes, which can be addressed with the equitable resilience framework proposed here.

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57. Interview with WRUA 3.
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68. Interview with WRUA 4.
69. Interview with WRUA 3.
70. Interview with WRUA 6.
71. Interview with WRUA 5.
72. Interview with WRUA 11.
73. Interview with WRUA 9.
74. Interview with WRUA 2.
75. Interview with WRUA 5.
76. Interview with WRUA 7.
77. Interview with WRUA 9.
78. Interview with WRUA 8.
79. Interview with WRUA 1 and 2.
80. Interview with WRUA 1.
81. Interview with WRUA 4.
82. Interview with WRUA 8.
83. Interview with WRUA 5.
84. Interview with WRUA 2.
85. Interview with WRUA 4.
86. Interviews with WRUAs 1 and 4.
87. Interview with WRUA 4.
88. Interview with WRUA 6.
89. Interview with WRUA 10.
90. Interview with WRUA 9.
91. Interviews with WRUAs 4 and 9.
92. Interview with WRUA 12.
93. Interview with WRUAs 4 and 10.
94. Interview with WRUA 10.
95. Interviews with WRUAs 3 and 10.
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Author contributions

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Data availability statement

The datasets generated and analysed during this study will be made available in Cranfield University's CERES Research Repository (<https://dspace.lib.cranfield.ac.uk/handle/1826/20712>) and, in the meantime, can be obtained by contacting the first author.

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