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Research, part of a Special Feature on Everyday Adaptations to Climate Change

Everyday mobility and changing livelihood trajectories: implications for vulnerability and adaptation in dryland regions

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ABSTRACT. Dryland regions are highly dynamic environments in which multiple pressures intersect, threatening livelihood security. Mobility is an integral feature in these environments and represents a key risk management strategy for people to respond to frequent livelihood shocks and stresses. Global environmental change scholarship has tended to articulate spatial and temporal change inadequately, portraying populations in a way that belies their socially differentiated and inherently mobile livelihoods. We explored the role of mobility as an ongoing, "everyday" adaptive response to changing environmental, economic, and social conditions. We draw on 21 Life History (LH) interviews to explore the drivers and outcomes of people's mobility behavior in drylands of Ghana, Kenya, Namibia, and India. We present the adaptation option space (AOS) as a novel theoretical development to explore livelihood trajectories. Within our cases, we found that mobility was ubiquitous and facilitated changes to and exchanges within people's risk profiles in three main ways: novelty (risks gained or lost), modification (risks attenuated or accentuated), and no change. Temporal analysis showed three broad trajectories in people's lives set within broader structural constraints: upward, downward, and stable, depending on people's abilities to manage their AOS. The analysis confirmed that the AOS was a useful heuristic to understand how people exert agency to respond to an array of converging risks while negotiating broader drivers of change. Moreover, the data demonstrated how compounding shocks had negative impacts on people, highlighting the value of temporally-sensitive approaches.

Key Words: *adaptation; climate change; drylands; mobility; risk; temporality*

INTRODUCTION

The drylands of the world are the largest global biome (Schimel 2010), covering between 41% and 45% of the earth's surface (Prăvălie 2016) and accommodating more than a third of the globe's population. Drylands are characterized by low and highly variable precipitation and high temperatures; limiting fresh water availability and other essential natural resources (Reynolds et al. 2007, Huang et al. 2016, IPCC 2019, ILRI 2021). These regions are experiencing multiple pressures, including increasing rates of aridity and soil degradation, poorly planned and implemented development interventions, rapid population growth, historically high rates of poverty, poor communication infrastructure, and isolation from national centers of power, stressing livelihoods reliant on natural resources (Sietz et al. 2011, Reid et al. 2014, Shackleton et al. 2015, Stringer et al. 2017). Although pastoralism dominates dryland regions, rainfed and irrigation agriculture, waged labor and other forms of employment in burgeoning towns, different forms of trade, and exploitation of natural resources are also common livelihoods.

Anthropogenic climate change poses additional risks to often already tenuous livelihood security in dryland regions (Tucker et al. 2015). For example, the drylands of East Africa will warm faster than the global mean, seeing greater incidences of extreme events, such as the number of consecutive dry days, hot spells, and storms (Osima et al. 2018). Similar changes are modeled for dryland regions of West Africa (Diedhiou et al. 2018), southern Africa (New 2018), and India (Ramarao et al. 2019), suggesting that the coming decades will become more challenging, especially when considered alongside current natural resource degradation and livelihood precarity (Stringer et al. 2017, IPCC 2019). The potential negative implications of these processes re-emphasize the importance of understanding why populations are vulnerable and the options they have to respond to livelihood threats (Cervigni et al. 2016a, Shukla et al. 2017).

Mobility, as an integral component in many people's lives and livelihood portfolios, constitutes a key risk management strategy (Wiederkehr et al. 2018, Cundill et al. 2021). Over time, mobility behavior changes as do the risks and vulnerabilities that people experience (Adger et al. 2003, Ribot 2014, Joakim et al. 2015, Otto et al. 2017, Singh and Basu 2019). Despite the knowledge that risks and responses are dynamic and linked (recursively), temporally-sensitive research that actively seeks to explore relationships between mobility and vulnerability, adaptation, and well-being is limited (Fawcett et al. 2017). This dearth of empirical evidence and an associated corpus of theory minimizes opportunities to challenge approaches that implicitly privilege static understandings of the world and support interventions that better accommodate dynamism and flux in populations (Ford et al. 2010, Krishna 2010).

The focus of our research is on dryland regions in Africa and India, where mobility is instrumental in enabling livelihoods (de Haan et al. 2016). Despite the importance of everyday mobility to livelihoods in dryland regions, it remains a neglected area of study within global environmental change literature, and a poor relation to the much more recognized and studied forms of mobility behaviors, such as international, national, and place-based work on migration and environmental change (Boas et al. 2019, Kothari and Arnall 2019, Cundill et al. 2021). The tendency to focus on rural to urban migration or movement driven by extreme events masks the importance of everyday mobility and the crucial role these forms of movement play in people's risk management and adaptation behavior.

We focus on mobility as an everyday adaptation response to environmental change and other dynamics in dryland regions. The novelty of our study is twofold: we develop a heuristic, the adaptation option space (AOS), to explore adaptation behavior, and we generate new empirical insights by dissolving the

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compartmentalized way research on mobility has been pursued in dryland regions. To do so, we use a Life History (LH) methodology (Singh et al. 2019) to understand people's livelihood trajectories, capturing the temporality of risks, livelihood choices, and adaptation outcomes and their interrelationship. Through this approach, we shed light on the use of mobility and the dynamic nature of risks, responses, and well-being within the context of dryland regions, which remain underrepresented in the literature on climate change adaptation.

LITERATURE REVIEW

The "everyday"

Climate change is frequently portrayed as something exceptional or abnormal, a rupture from the daily rhythms of life, which cannot be assimilated into the everyday. Yet climate change is something people live with, interpret, and act on continually based on their own particular understanding of the world around them (Hulme 2009). As we come to understand the nature, scale, and urgency of the societal changes required to respond effectively to climate change, the importance of moving away from a framing of exceptionality toward one that seeks to integrate action and understanding on climate change within the rubric of the everyday becomes more compelling (Hornidge and Scholtes 2011, Duvernoy 2020). At a broader scale, studying the everyday can appear inappropriate and ill-suited (Kothari and Arnall 2019). However, in focusing on the everyday we are required to reinterrogate how some of the larger issues in adaptation science are refracted through everyday practices. For example, Funder and Mweemba (2019:130) observe that the "less conspicuous" daily practice of climate governance is often neglected even though it is through these on-the-ground actions that climate policies and programs are implemented. Artur and Hilhorst (2012) make a similar case in relation to the discourse, asserting that climate discourse is given form only through everyday practice. Lastly, and more directly related to our focus, Schofield and Gubbels (2019:94) assert that a "gap persists between how the effects and risks of climate change are encountered as everyday realities by people experiencing them."

For the purpose of our research, the everyday enables us to refocus our analytical lens and disrupt the powerful notion of climate change as exceptional, and instead reframe the object of enquiry onto daily activities, behaviors, and practices (Oppermann et al. 2018). Kothari and Arnall (2019) argue that although the everyday is seen as unexceptional and normal, mundane even, it provides a valuable window to understand and explore the connections between environmental change and how people respond to those changes. Changes can include those that are more regular and predictable, such as seasonal change, as well as those that are more unusual or seen as a rupture from the norm, such as chronic drought. Despite the growth in studies using the everyday as an analytical and interpretive lens, there is surprisingly little literature that explores connections between people's daily practices and changes in the environment and, more specifically, in dryland regions where mobility is used to respond to changing conditions at different temporal scales. Generating knowledge on the everyday responses to change is important because, although climate change is clearly an "exceptional" phenomenon, it is given form and meaning through its everyday manifestations. In essence, exploring climate change in terms of how it is grounded in the local and familiar landscapes of everyday life in dryland regions provides an opportunity to connect with and understand the real and perceived effects of climate change its impact on people (Brace and Geoghegan 2010).

Drylands and dynamic mobilities

Mobility is an essential feature of livelihoods in dryland regions (Stafford Smith et al. 2011, de Sherbinin et al. 2012). In spatial and temporal terms, people interweave different forms of movements across scales as they navigate their life course (Parsons 2017, Cundill et al. 2021); instances of mobility are not a series of compartmentalized and discrete events that interrupt longer periods of immobility. When viewed in this light, the more exceptional forms of movement, which are commonly studied but occur comparatively infrequently, are part of a spectrum of mobilities people employ at different frequencies in response to a range of dynamics and a diverse portfolio of livelihood practices (Goodall 2004, Hunter et al. 2015, Singh 2019, Gongbuzeren et al. 2021). Despite the more commonplace and everyday mobilities being the lived reality for many, it is exceptional mobility that draws attention, indicating a surprising oversight in scholarly enquiry.

Within dryland regions, the most notable and "visible" forms of mobility are pastoral mobility (Catley et al. 2013), rural to urban migration, labor, or seasonal migration (Neumann and Hermans 2015), and, more recently, mobility associated with environmental change (Borderon et al. 2019). With regards to pastoral mobility, we are seeing a decline in broad scale movements as constraints on mobility are increasingly pronounced as land becomes more fragmented and enclosed (Reid et al. 2014, Carabine et al. 2015, Nyberg et al. 2015, Greiner 2016, Mosley and Watson 2016), and there appears to be a general shift toward more sedentary lifestyles (Mganga et al. 2015, Cervigni et al. 2016b, Greiner 2016, Watson et al. 2016). As broader scale movements decline, the likely attendant increase in finer scale movements is increasingly recognized as significant (Liao et al. 2020), but remains marginal to scholarly interest. Similarly, although scrutiny has focused on the importance of rural to urban and seasonal migration as a significant and ongoing dynamic within dryland regions (e.g., Wiederkehr et al. 2018, Cattaneo and Robinson 2020), it is not the only form of mobility linked to economic opportunity. As with the example above, the broader scale movements that have received much attention are superimposed onto a pattern of finer scale movements necessary to access local markets, smaller towns, and urban centers at greater frequency (Stafford Smith et al. 2011), or signifying deeper changes as some people abandon pastoralism altogether (Catley and Aklilu 2013, Camfield et al. 2020). These two examples suggest a blind spot for the finer temporal and spatial forms of mobility despite their importance (Hunter et al. 2015).

As with mobility, vulnerability, risk, and adaptation are not static: they change temporally (Ford et al. 2010, Fawcett et al. 2017). Such dynamism is a feature of all social-ecological systems (Gunderson and Holling 2002). Yet, much scholarship implicitly portrays the world as a series of discrete points in time with only weak links between them. Studies of migration under conditions of environmental change are an example. They are not generally adept at representing dynamic elements and the interactions between them. These approaches can be grouped into five broad analytical categories: exposure, hotspot, attribution, proxy-attribution, and ethnographic (Piguet et al. 2011, McLeman 2013,

Table 1. Summary of the main approaches researching environment migration relationships (Piguet et al. 2010, Bilsborrow and Henry 2012, McLeman 2013, Fussell et al. 2014, Eklund et al. 2016, Piguet et al. 2018).

Type	Description	Data and analytical approach	Ability to represent temporal issues	Examples
Exposure approach	Measures exposure to some sort of environmental change for a given area and models the expected number of people to migrate away should that change take place.	Socio-economic data often combined with biophysical data on, for example, sea level rise, flood risk, forest condition, etc., to enable an integrated assessment of vulnerability. Analysis tends to be at the level of the country or region.	Poor. Explores those exposed to a potential hazard and infers the likelihood that they will utilize migration as a response/ adaptation. Prospective.	Black et al. 2008, Nicholls et al. 2008, Ellison 2015, Davis et al. 2018b, Guidi et al. 2018
Hotspot approach	Assumes a relationship between some sort of environmental change and undertakes research to probe for evidence of a relationship.	Data generated through a combination of methods including interviews (key informant, individual, and group) and surveys. Often populations of interest are over sampled. Data tends to be generated at the level of the community or household through case studies.	Poor. Tends to focus on a single event or change process without exploring change over longer periods of time. Retrospective.	Warner 2011, Warner and Afifi 2013, Rigaud et al. 2018, Maharjan et al. 2020
Attribution approach	Probes for a quantitative relationship between population and environmental change. The approach incorporates change over time and can more easily show causal links between change in migration behavior and environmental change.	Large n surveys or census-type data combined with data on environmental change processes. Data often analyzed at a single scale (although there are some multi-scale studies) using techniques such as hazard or event history analysis.	Reasonable. Recreates migration histories in relation to an environmental change event or process. Focus often on one movement/change of residence within a fixed period of time. Retrospective.	Henry et al. 2004a, Henry et al. 2004b, Fussell et al. 2010, Gray and Bilsborrow 2010, Henry and Dos Santos 2013, Grace et al. 2018, Thalheimer et al. 2021
	As above but samples the same group of people at different points in time to understand the timing of the migration behavior with the environmental change process.	Often (but not exclusively) large n panel data combined with data on environmental change processes. Analytical approaches are similar to those above but also include fixed-effect models.	Reasonable. Focuses on a series of fixed points in time to support attribution but does not probe links between these points (retrospective).	Gray and Mueller 2012, Hunter et al. 2013
	Uses past migration behavior to develop a set of hypotheses that are used to model behavior.	Survey data employed to establish hypothesis that are used to parameterize e.g., Agent Based Models. Models used to analyze interaction of individual behavior and to explore group dynamics.	Good. Relies heavily on model parameterization. Prospective.	Kniveton et al. 2011, Smith 2014, Entwisle et al. 2016, Thober et al. 2018
Proxy-attribution approach	Uses variables/sectors that are sensitive to changing environmental conditions such as agriculture. Changes in variables correlated with migration change to infer link with environmental variables.	Census and data for variables (such as crop yield) sensitive to environmental change processes or events and climatic variables used to develop models to explore migration behaviors on a regional or national scale.	Reasonable. Relies on adequate representation of semi-elasticity of relationships between key variables. Prospective.	Barbieri et al. 2010, Feng et al. 2010
Ethno-graphic approach	More qualitative and ethnographic and interested in generating insights into people's perceptions of change and their own explanations into the links between mobility and environmental change.	Individual cases (that tend to be either a person or household) through which qualitative data are generated and analyzed to understand the importance of environmental change in migration behavior.	Good. Supports multi-causal approach to understanding migration dynamics. Retrospective.	Ayeb-Karlsson et al. 2016, Singh and Basu 2019, Ayeb-Karlsson 2020

Fussell et al. 2014, Eklund et al. 2016, Piguet et al. 2018; Table 1). Within these approaches, divergence occurs along a number of axes, such as scale, whether they are primarily retrospective or prospective, data type (qualitative or quantitative), and analytical approach (Thalheimer et al. 2021). The primarily quantitative approaches (attribution and proxy-attribution) tend to analyze mobility behavior to detect the environmental signal (Kniveton et al. 2008, Findlay 2011, Piguet et al. 2011), whereas mixed-methodologies and more qualitative approaches seek to understand how mobility behaviors are perceived and understood within the lived reality of people's lives (Singh et al. 2019). Within this portfolio of methodologies, some, such as the attribution approaches, are more skillful than others at understanding and probing temporality.

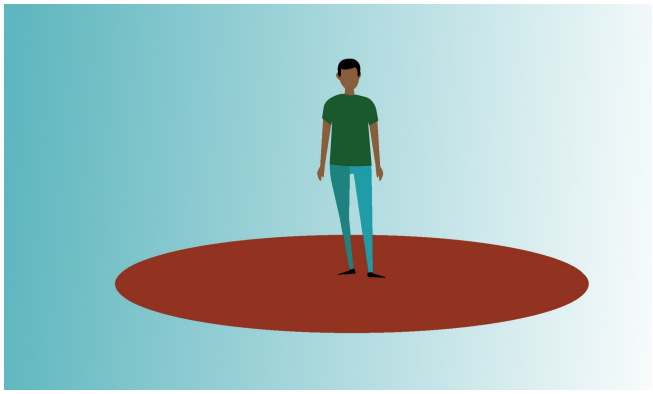
Two notable issues persist. First, taking environmental change as the independent variable promotes a focus on mobility linked to environmental change. Yet, lives are not lived by prioritizing the environment above other considerations. We discussed that mobility is fluid, scalar, and multi-causal (Bakewell 2010, Bardsley and Hugo 2010). Therefore, trying to understand how mobility has been used within a person's life provides a more contextual understanding that better values people's well-being above a focus on when and how mobility is used in relation to environmental change (Farbotko et al. 2018). Second, even in the methodological approaches that actively conceptualize temporality, only a few get beyond simplistic models that adequately represent temporal change (Singh et al. 2019).

Risk, response, and the adaptation option space

Climate change studies have developed multiple ways to conceptualize how people negotiate and respond to risks (for comprehensive reviews of this concept see Giupponi and Biscaro 2015, Räsänen et al. 2016, Jurgilevich et al. 2017, Thomas et al. 2019, Simpson et al. 2021). Initial studies theorized vulnerability as an outcome of external stressors or hazards acting upon a system or unit of analysis, such as people or populations (Brooks 2003, Füssel and Klein 2006). However, this hazard-stressor model was critiqued for being too simplistic and linear in its understanding of complex, interacting, and multi-scalar

processes of risk and response (Ford et al. 2010, Ribot 2014). Vulnerability is inherently contextual (Tucker et al. 2015), characterized by an underlying set of structural conditions (Joakim et al. 2015:147) that mediate how "climate change is experienced and which shape(s) responses available to adapt" (Ford et al. 2010:377). Building upon this view of vulnerability as structural and historically-constructed (Tschakert et al. 2013, Ribot 2014, Eriksen et al. 2021), the "risk space" can be understood as not only the exposure of systems or people to a hazard or stressor, but also a space that is critically mediated by contextual vulnerability (Fig. 1).

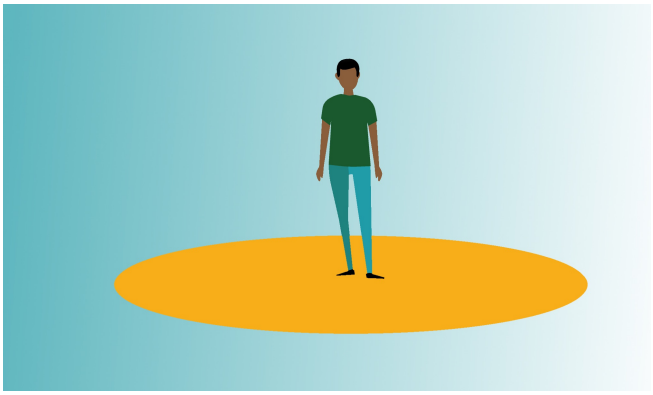
Fig. 1. The risk space (red disc) set within contextual vulnerability (blue area).



The well-established and large body of research spanning social anthropology, critical human geography, political ecology, and hazards (Watts and Bohle 1993, Forsyth 2003, Blaikie 2004, Ribot 2010, Otto et al. 2017, Ford et al. 2018, Thomas et al. 2019) shows that vulnerability is socially generated and not an intrinsic characteristic of a given unit of analysis. Recognizing that the risk and response spaces have their roots in society maintains an analytical focus on the more immediate actions, opportunities, and limitations, as well as the ways society produces and reproduces conditions that can result in negative outcomes, such as loss and damage to assets, impacts on livelihoods, or loss of dignity (Wiederkehr et al. 2018). Contextual vulnerability varies temporally between places and populations, is relational, scalar, and dynamic, and is a crucial element within the AOS framework. The incorporation of contextual vulnerability within the framework enables one to explore how vulnerability is socially differentiated and how it interacts with the AOS (Haasnoot et al. 2020). For instance, by understanding how contextual vulnerability differs along lines of gender and ethnicity-based marginalization we can explore how this influences the risks populations are exposed to and the responses that are available to them (Thompson-Hall et al. 2016, Boas et al. 2022).

To cope with and adapt to risk, actors practice multiple risk management strategies. Several heuristics have been put forth to conceptualize this range of risk management behaviors and examine why different people undertake different responses. Using a livelihoods lens, Osbahr et al. (2010:1–2) articulate the "response space" as "the set of options open to actors trying to enact multiple livelihood and development outcomes," and it includes short-term reactive coping strategies as well as longer-term, more planned adaptation responses (Fig. 2). Singh et al. (2016) stretch the response space heuristic further to define a "response continuum," which spans responses from undertaking no response, through maintaining the status quo to coping, which is typically short-term and may lead to adaptations or exacerbate vulnerability, and finally, adaptation, implying a more permanent, forward-facing change. Such a definition acknowledges that people may undertake several responses simultaneously and that these are mediated by cross-scale drivers and actions. Schipper (2020) extends this idea of a continuum to showcase how risk management can lead to adaptation and/or maladaptation, with implications on whose vulnerability is reduced or not.

Fig. 2. The response space (yellow disc) set within contextual vulnerability (blue area).

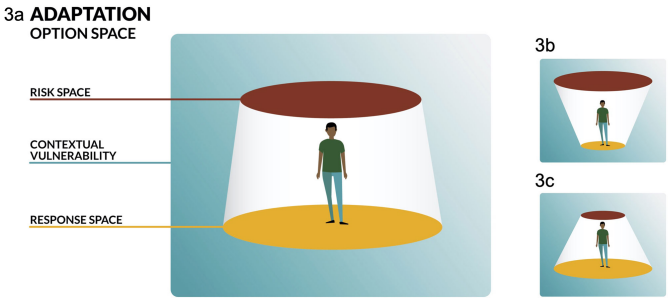


A smaller subset of the response space is the "adaptation space" (Adger 2003:401), that alludes to the availability of and access to adaptation options that a person possesses and is able to enact. Adger et al. (2003:193) argue that safeguarding and strengthening this adaptation space is "a central development imperative" but do define not the term comprehensively. The adaptation space has also been used to highlight issues of politics and agency in adaptation decision making (Pelling et al. 2015:113) through a framing of the "adaptation activity space" that includes seven coevolving sites: the individual, technology, livelihoods, discourse, behavior, the environment, and institutions. More recently, the idea of adaptation space has been used to examine how past development decisions have impacted ecological and social systems to affect present-day adaptive capacity and availability of adaptation options (Gajjar et al. 2018).

Other adaptation scholarship invokes the idea of lost opportunity costs to take advantage of "unique windows of opportunity" (Hallegatte 2009:246) to reduce future adaptation needs, and staying within "adaptation limits" because "opportunities and resources to adapt may be finite for many social actors" (Dow et al. 2013:305). These heuristics suggest that the space to adapt is limited, it varies over time and by social grouping, and that different people have different levels of access to this space. Looking to the future, adaptation pathways approaches (Werners et al. 2021) emphasize how, without urgent action, the space to adapt can become constrained, especially for vulnerable populations who lack the means to respond to livelihood stressors effectively.

Figure 3 consolidates our understanding of the AOS, which is determined by the amount of risk a person or population is exposed to and their ability to respond. Both the risk space and the response space can move independently but are linked through the AOS and change temporally. For example, the risks that a person is exposed to, such as drought causing failed crops or livestock death, can increase or decrease, whereas their response space remains static, resulting in top-heavy and unstable AOS (Fig. 3b). Conversely, through social networks or entrepreneurship for example, the response space can increase whereas the risk space remains static. In this formulation, the AOS, with a wider base, is more stable and desirable (Fig. 3c).

Fig. 3. (A) The Adaptation Option Space (AOS); the white area in the figure, mediated by the risk and response space and contextual vulnerability. (B) Unstable AOS showing large risk space and small response space. (C) Stable AOS showing small risk space and large response space.



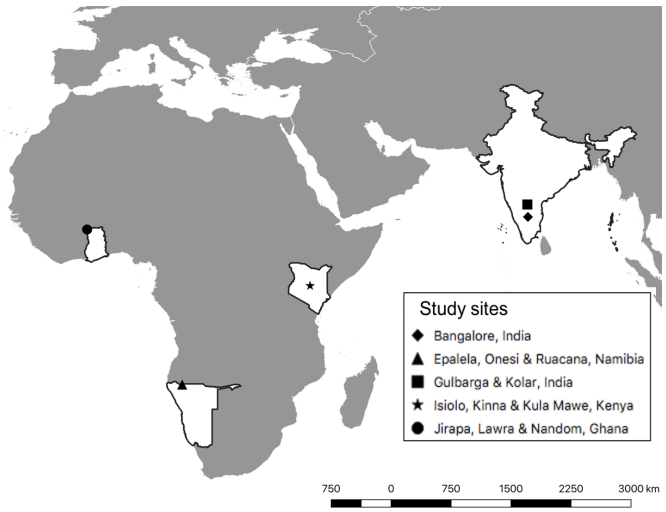
We apply this AOS framing to conceptualize livelihood decisions and outcomes for risk management in drylands with recent advances in climate change vulnerability and adaptation research, arguing that this framing pays explicit attention to (1) contextual vulnerability and the structural factors that shape choice and decision making; (2) the agency and barriers to risk management and livelihood choices; and (3) temporality by focusing on dynamic decisions.

METHODS

Life History (LH) methodologies provide a useful counterpoint to the larger scale and more quantitative approaches that dominate the literature on mobility and environmental change. The use of LHs to understand temporal change within people's lives is common in other areas of social science, for instance migration (but not from an environmental change perspective), education, and studies on youth transitions (Thomson et al. 2002, Langevang 2008, Holland and Thomson 2009, Porter et al. 2010, Porter et al. 2011, Ansell et al. 2014, Etzold 2016). Despite the obvious strengths of understanding trajectories of change (Krishna 2010, Ayeb-Karlsson et al. 2016, 2020), LH methodology has rarely been applied to explore vulnerability and adaptation in relation to risks associated with climate change (Singh 2018).

The LH methodology is employed here to understand the role of mobility within the portfolio of individual and household risk management strategies. We drew on a total of 14 cases generated through 21 long-form, semi-structured LH interviews in dryland regions of Ghana, Kenya, Namibia, and India that were undertaken during 2016 and 2017 (Fig. 4). The research was part of a five-year, multi-country project, called Adaptation at Scale in Semi-Arid Regions (ASSAR), through which we investigated livelihood dynamics within the context of social and environmental change in the semi-arid regions of west, east, and southern Africa and Asia. In each of the four countries, different cases of two household members were purposively from locations within the wider research area. Davies et al. (2018) and Singh (2018) provide a more detailed description of the LH method we employed, including its strengths and weaknesses. We only report on the dynamics associated with mobility, livelihoods, well-being, vulnerability, and adaptation; the research design, site selection, and identification of participants were informed by other research within the wider project.

Fig. 4. Map showing locations of case study sites.



The three sites in the Upper West Region of Ghana were Jirapa (a business and government hub), Nandom (a smaller farming community situated closer to Burkina Faso's south-western border), and Lawra (a predominantly business and farming community). Most livelihoods are agriculture-based, including crop farming and goat rearing. In Kenya, the three sites were two rural villages within Isiolo County, Kachuru (a small settlement of Meru and Boran pastoralists and traders situated at the foot of the Nyambene Hills), and Kulamawe (a large pastoral village dominated by Boranas), and Isiolo Town (the capital of Isiolo County, where livelihoods are predominantly focused on farming, livestock trading, and entrepreneurship). In India, the study sites in North Karnataka were Kolar district, where diversification to non-farm labor and daily commuting to Bangalore is common, and Gulburga district, where agricultural livelihoods dominate and there has been historical outmigration to large cities. In Namibia, the study sites were Epalela (a small business center), Onesi (a small settlement and district capital with some government offices and shops), and Ruacana (a small town and district capital with some tourist accommodation).

Participants (anonymized with pseudonyms) were purposively identified to sample a diversity of vulnerable households and mobility types. Sampling was informed by gender (male or female-

Table 2. Key characteristics of cases by location.

Country	Location	Case	Livelihoods	Risks
Ghana	Jirapa	Asana, 50-year-old female, widowed, household head, three children; Dede, 22-year-old female, eldest daughter of Asana	Farming, laboring, some casual work	Loss of assets due to family death, debts
	Nandom	Fuseini, 60-year-old, male, household head, married to Jilma. Jilma, 42-year-old female. They have five children	Farming, petty trade, and seasonal migrant	Debts, drought, family bereavement
	Lawra	Neira, 35-year-old female, unmarried. Sibiri, 24-year-old male, nephew of Neira	Entrepreneur, subsistence farming	Poor crop yields, no local livelihood opportunities
India	Bangalore/Kolar	Venkata, 48-year-old male, married. His wife and elderly mother live in the village and daughter has migrated to Bangalore.	Gardener in Bangalore city and a smallholder farmer in Kolar	Drought, falling water table
	Kolar	Latha, a female "Gram Panchayat" (local governance body) member, who is married. Her family are upper caste and relatively well off.	Farmer	High input costs, drought, falling water table
	Bangalore	Sriram, a permanent migrant from Gulbarga and lives with his family of five in an informal settlement in Bangalore city.	Government employee, wife manages a shop	Drought in rural areas
	Bangalore/Gulbarga	Ramesh, a 28-year-old man who moved from his village in Gulbarga to support the family.	Working as a painter in Bangalore and laborer in Golbarga	Debt, poor working conditions, drought
Kenya	Kule Mawe	Adan, 52-year-old, male household head. Aisha, 47-year-old female, married to Adan. They have nine children aged from three to 29 years	Livestock and livestock trading	Drought, conflict between Meru and Borana
	Kachuru	Makena, 40-year-old female, widowed, with seven children aged between two and 17. Hadiya, 37-year-old female, widowed, has 12 children. Shares child caring duties	Collecting firewood, petty trade and miraa business, some livestock	Debt, conflict, gender-based violence, drought
	Isiolo	Fatima, 29-year-old female, married with five children aged between one and 13 years	Runs small shop and husband trades miraa	Drought, conflict
		Jafar, 27-year-old, male, married, and head of household	Casual laboring	Lack of work/poor working conditions
Namibia	Epalela	Melisa, 48-year-old female, household head	Runs a sewing business in nearest town	Limited opportunities in village
		Patrick, 26-year-old male who lives with and is primary carer for his grandmother	Subsistence farming and livestock	Family bereavements, low wages/ high cost of living
	Onesi	Daniel, 50-year-old male, married with one son, originally from Angola	Mechanic	Property at risk of flooding
	Ruacana	Seblon, 23-year-old male, head of a large Himba household in Ongango, supports about 20–25 people	Waiter in a tourist lodge	None specified

headed households), age (all of productive age but sampled to include older and younger people), livelihood type (farming, pastoral, agro-pastoral, wage labor, business), level of transience (nature of the mobility), and exposure to environmental change and other risks, such as floods, droughts, or conflict (Table 2). The selection criteria were informed by in-depth research, including household surveys, key informant interviews, focus group discussions, and semi-structured interviews, undertaken in the research sites during 2015 and 2016. For this study, the LH interviews focused on understanding the householders' perspectives of key events, temporal changes, and their implications within their productive lives (normally within the last 10 years), and reflections on their well-being and aspirations for their families and the future (Davies et al. 2018, Singh 2018). Most of the interviews (thematically structured) took between two and three hours and wherever possible, we interviewed two members within a household to examine dynamics in their decision-making processes in relation to each other (for more details on methodology, interviewing process, and how we triangulated data see Singh et al. 2019).

The interviews were transcribed and analyzed using descriptive codes that were inductively developed based on emerging themes from the interviews. The research team co-developed the codes over two workshops to facilitate robust and comparative analysis. Through an iterative process of analysis, four large coding families were developed: (1) description of livelihood dynamics (risks, responses, type of livelihood shifts), (2) intra-household dynamics and decision making, (3) outcomes of responses (e.g., trade-offs, well-being outcomes), and (4) household pathways (e.g., of poverty, future aspirations). A key element of the analysis was the development of visual trajectories (Figs. 5, 6, and 7) that capture key (self-identified) points of significance (indicated by red dots in Figs. 5, 6, and 7) within the lives of our cases and the impact that it had on their well-being. The changes in the risk and response spaces within the visual trajectories were inferred based on the qualitative analysis undertaken by the research team.

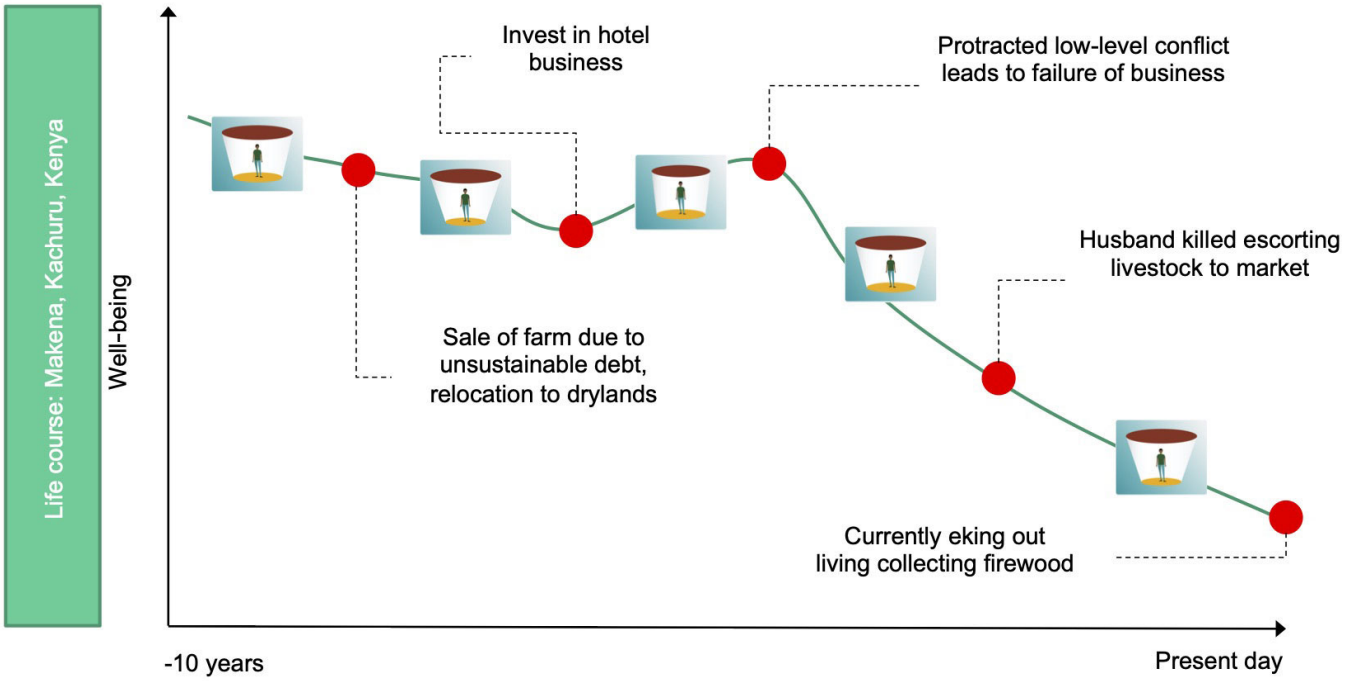
RESULTS

Across the four dryland regions, mobility was an essential feature of many livelihoods (e.g., pastoralism, natural resource-based, and trading): it enabled people to access work opportunities (e.g., through commuting), provided a means to relocate and swap one location for another, and helped people manage risks linked with environmental and other changes.

Dynamic risks and responses

Empirical analysis showed that mobility intersected with other drivers and acted on people's and households' risk portfolios in one of three ways. Some risks were completely lost through mobility

Fig. 5. A downward trajectory (Makena).



whereas others emerged representing new threats that required management (novelty), other risks were either attenuated or accentuated (modification), and the final category shows some risks move with people but, in essence, remained relatively static (no change).

Within all cases, mobility was a key strategy employed to manage ongoing and emergent risks and highlighted the multi-causal nature of people's responses. Looking at the specific classes of risk, for novelty, mobility was often employed to relocate from one settlement to another, in so doing people obviated risks associated with contextual vulnerability linked to their position within society in terms of gendered risks or caste-based discrimination for instance.

> *In the village, we were subservient to the Gowdas [landowning caste] and depended upon them for sustenance and livelihood. In the city, we can lead independent lives* [Sriram].

> *He [husband] had sold one piece of land and they started evicting us wanting even to kill him.... They continued fighting and even killed his animals... That's when he come down here* [Makena].

However, although moving helped to reduce some risks, it increased the exposure to other risks, such as flooding in the case of Sriram and occupational health associated with new forms of employment in the case of Ramesh.

> *We faced difficulties [flooding] when we initially moved into Bangalore.... [We were] new to the city* [Sriram].

> *The work [as a painter] is hazardous as one has to take the support of ropes to stand on while painting the exteriors of a building. It has given me a dust allergy. I fell ill two years ago... was exposed to a lot of dust* [Ramesh].

The quotes above emphasize how mobility is often a double-edged sword; moving can eradicate or reduce some risks (linked to contextual vulnerability in the examples above), while simultaneously expose people to novel risks. Most of the emergent risks were linked to the new location, which was often urban and included issues associated with increased living costs, the precarious nature of urban livelihoods, and higher exposure to hazards.

The LHs demonstrate how people modify risk by moving. For example, to minimize exposure to drought, Neira and Sibiri took advantage of extended family connections, and Maria increased her skills and diversified her livelihood.

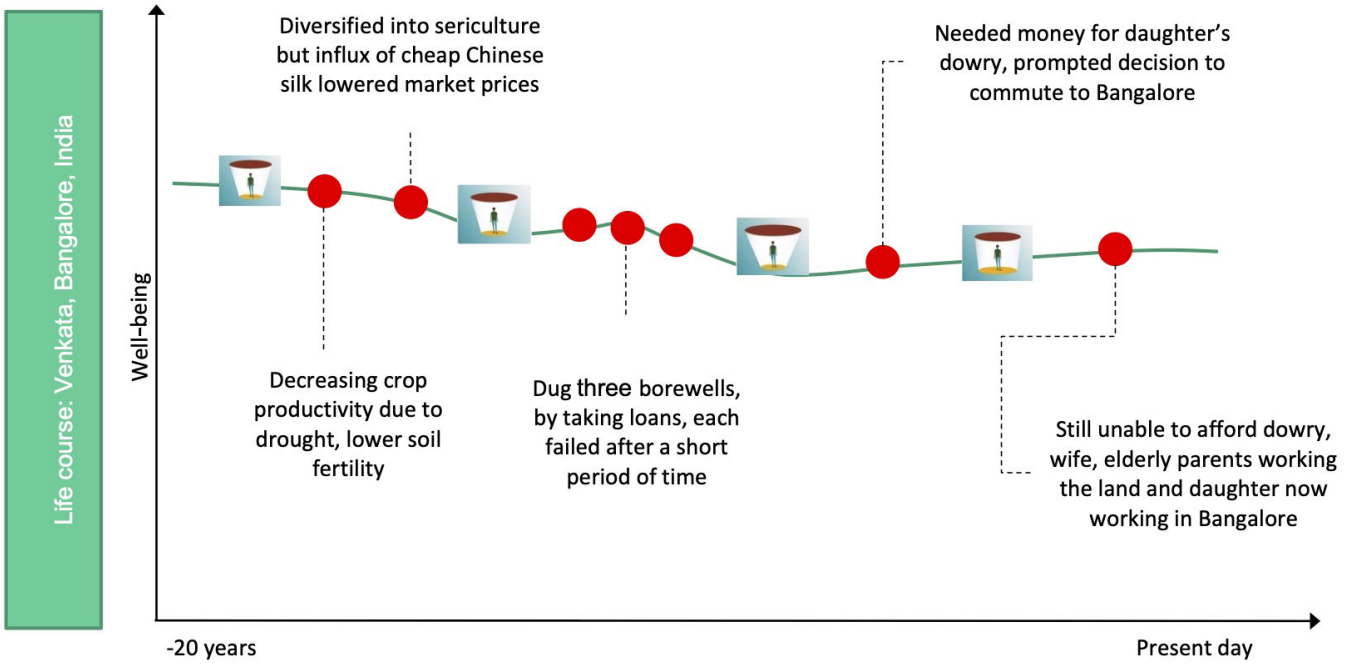
> *It [diversified income sources] brought more benefits to the family because I helped pay my sister's schooling when I was working at Oshakati* [Maria].

> *The quality of my life changed [for the better] when I moved out of the village to settle with my Aunty* [Sibiri].

In some cases, despite people's best intentions, exposure to risks increased. The most obvious example within our cases was shown in the ways conflict and familial deaths impact livelihoods in dryland Kenya (Adan and Aisha) and Ghana (Fuseini), accentuating risks and making it more difficult to practice one's livelihood.

> *Yes, there is a time I used to buy livestock and add to my herds as profit... before the conflict... but after that it was just a struggle* [Adan].

Fig. 6. A stable/fluctuating trajectory (Venkata).



> *When I moved, my financial situation started going down because of all the challenges I had with my farming activities and the tragedies (deaths) that occurred in my family* [Fuseini].

Although the risks themselves were strongly associated with specific livelihoods, they also hint at the additional ways contextual vulnerability was produced in society. In these cases, chronic conflict, which erupts periodically and was simply unavoidable for many, and the often-inadequate social floor undermined the already marginal livelihoods practiced.

In other cases, whether mobility was utilized or not, it was simply impossible to eradicate risks (no change) that one was exposed to. For example, the high costs of urban living (Sibiri) and the multifaceted nature of poverty (Fatima) showed that mobility has not brought about improvements in well-being and that daily survival remained the paramount concern.

> *Even though I had moved I didn't want to because I realized I may not achieve my aspirations at city so I had to come back home* [Sibiri].

> *Life is very hard here also when you don't have a job, there are school fees, and business is not doing well for the last two and half years and if am given opportunity I can even go back to Gafarsa* [Fatima].

In these examples, risks that were more structural or integral reproduced themselves regardless of change in location or livelihood and clearly showed the importance of considering contextual vulnerability within climate change vulnerability and adaptation research.

The focus on risks showed the variety of responses (of which mobility was often essential) that people employ to actively manage and respond to ongoing and emergent risks. However, this tells only part of the story. Understanding a person's trajectory requires knowing how they have responded at a particular point in time and the consequences of their actions and how they enable or inhibit subsequent response.

Trajectories of change

The dynamic relationship between livelihood shocks and responses is evident in our data, and the data reveals great diversity in the nature, severity, duration, and frequency of shocks and the different ways that people respond, resulting in a range of well-being outcomes. Broadly speaking, there are three clusters of cases. At one end of the spectrum are households that manage to maintain an upward trajectory in terms of well-being despite facing a myriad of shocks, whereas at the other extreme, another cluster demonstrates a downward trajectory. In between these poles are a further cluster of cases that show fluctuation, but, ultimately, tend to retain a relatively flat trajectory, equating to no real improvement in well-being but also no deterioration. Across the responses and within people's personal trajectories, mobility is often crucial.

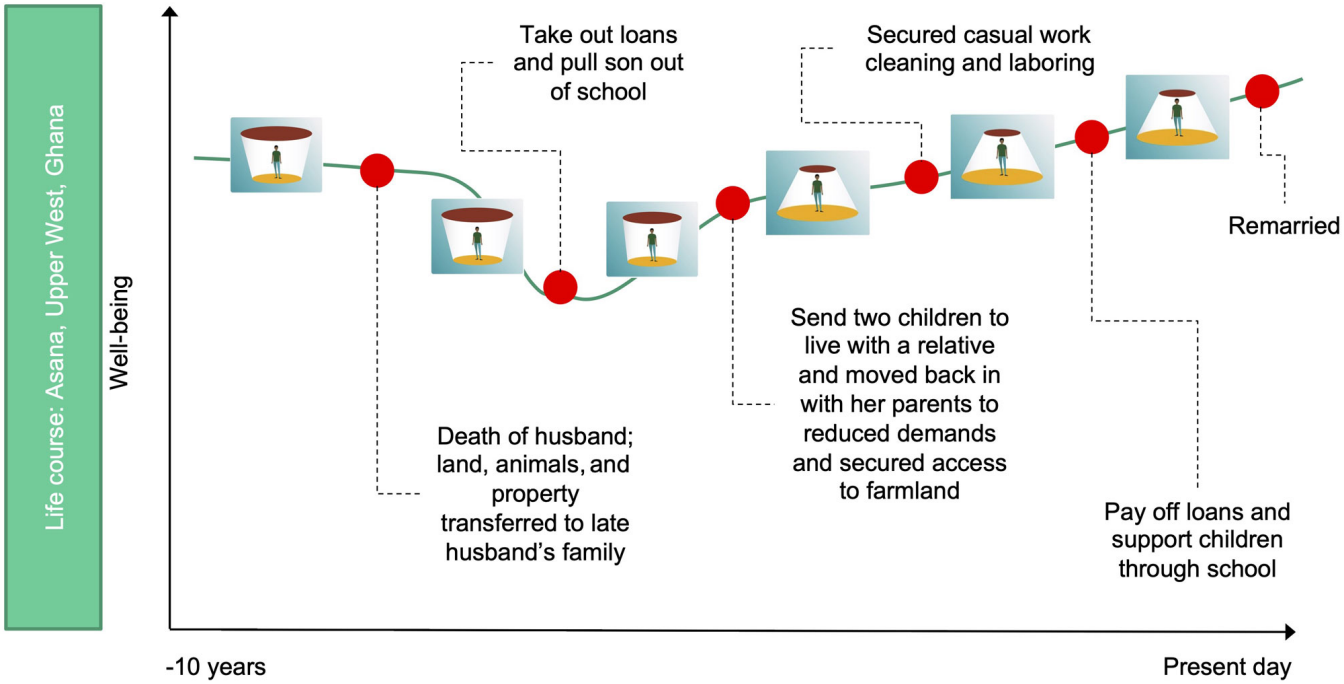
Navigating a downward trajectory

Within the cases showing a downward trajectory (Fuseini, Jilma, Ramesh, and Makena; Fig. 5), different risks interact with each other and limit the AOS. This cycle of increasingly severe impacts of risk events allied to an ever-smaller AOS locks people into a downward trajectory or cycle and is typified by Fuseini,

> *At some point within the past 10 years it [well-being] was going down because of all the challenges I had with my farming activities and the tragedies that occurred in my family* [Fuseini].

In other examples, we can see that Makena elected to relocate to Kachuru, and Ramesh perceived better opportunities in cities, such as Hyderabad, Pune, and Bangalore. Makena and Ramesh

Fig. 7. An upward trajectory (Asana).



utilized their knowledge and skills, existing assets, and social networks to develop and pursue livelihood options in new locations. However, in attenuating some risks, such as low income and threats of violence, they open themselves up to other emergent risks. Ramesh moved to Bangalore city as a painter but fell ill repeatedly as a result of his work and had to return to the village since he had no ties in the city and hospitals were prohibitively expensive leading him to conclude that,

> *There is no significant improvement in my life compared to that of my parents. I am unable to break this cycle of poverty that my parents also had to face. We are unable to come out of this and move forward in life* [Ramesh].

Similarly, Makena and her husband exposed themselves to increased risks of violence that ultimately resulted in the death of Makena's husband.

> *When he [husband] died I continued with my jobs there is no time I have ever gotten enough money.*

The agency that the cases demonstrate as they attempt to navigate through a shifting terrain are often confounded by larger social, political, and economic changes, the contextual vulnerability that limit or otherwise inhibit the range and effectiveness of responses. Such was the despair that Makena felt that she concluded that, "my only hope is my children."

These contextual vulnerabilities act to trap people in a downward trajectory limiting their well-being and offering little hope of improvement without external assistance or changes to underlying societal conditions.

Iterating risks and responses but ultimately stable

Cycles of drought and recovery are a feature of many dryland livelihoods. Sometimes, we see people's lives fluctuating as they experience and navigate different stresses and shocks in their lives. Adan is a case in point and has been able to recover from successive droughts and ethnic conflict by focusing more on trading of livestock than subsistence pastoralism. Through trade, the enclosure of land, and good knowledge of economic conditions and appropriate markets for purchasing and selling livestock, he is able to better manage his herd and respond to price fluctuations. This enables him to maximize his profits and maintain a reasonably stable life despite the frequent livelihood shocks he and his family have experienced.

> *I can attribute it [my recovery] to my livestock trade which was able to take away my daily expenses and I can sell my sheep and goats for paying school fees* [Adan].

> *[My] husband has better livestock, even the parents had livestock but not as big as my husband's and [we are] not badly off* [Aisha].

Livelihood diversification is also adopted by Venkata (Fig. 6). Living in Kolar, a drought-prone and increasingly water-scarce district 80 km away from Bangalore city, smallholders like Venkata have few options during prolonged drought. With the district being declared drought-hit since 2013, Venkata narrated finding it very difficult to continue farming.

> *Growing up, I have seen my father struggle to feed the family. The only way he could do so was [to] be incrementally selling off his land." Whereas now, "At least they [his children] have finished secondary school and can support themselves and the family if needed* [Venkata].

He took loans to dig borewells and tap into groundwater to use as protective irrigation but each of his three borewells stopped yielding water after 8–12 months of use. Compounding this setback was the large expense needed for his daughter's marriage and dowry, which finally motivated him to move out of agriculture and look for a "more stable and remunerative" job. Today, Venkata commutes to Bangalore daily where he works as a gardener while his elderly mother and wife continue to work in the fields and tend to their livestock. Despite this shift away from farming, Venkata is still unable to pay for his daughter's dowry and so she has taken up work in Bangalore as a domestic helper to save enough for her marriage.

In different ways, the two cases highlight the importance of everyday mobility in facilitating diversification as a means through which inhabitants in the rural dryland regions seek to minimize risk and maintain their AOS. For Adan, this has seen him focus increasingly on trading livestock, enabling him to respond more flexibly to the variability in the environment and economic conditions, and at times, constrained access to markets (mediated by conflict). Venkata has employed mobility to help his family diversify their income sources to include gardening in the city while continuing to farm in their rural area. The interaction of the risk space and response space over time shows Adan increasing his AOS through the adoption of trading as a more agile livelihood augmented by the enclosure of land to provide a more reliable source of fodder for his livestock. For Adan, although the risk space has remained relatively static, his ability to manage livelihood shocks has improved. For Venkata, similar (unsuccessful) attempts were made by digging borewells, limiting his AOS and leaving him vulnerable to drought (in part driven by contextual factors encouraging greater exploitation of groundwater). As a result, Venkata elected to diversify by working in the city as a gardener ensuring that the family have at least one source of income that is relatively insulated from the impacts of drought. In these examples, we see lives punctuated by shocks and under varying degrees of stress, yet well-being remains relatively stable as a consequence of the continual adjustments and innovations people make to manage their evolving risk profile.

Upwardly mobile

Three cases (Asana, Maria, and Sriram) showed an upward trajectory within our data, two of which we now expand upon. Asana lost her husband, which resulted in her household's animals, land, and property being transferred to her late husband's family as is customary, highlighting the contextual vulnerability linked with gendered norms (Fig. 7). Without any support from her husband's relatives, Asana struggled to make ends meet. She had to take out loans and pull her son out of school, which caused major disagreements within the household. Then, she decided to send two children to live with another family member and to move back in with her parents in another settlement, called Jirapa. These responses reduced the demands on her and helped her to secure access to farmland.

> *My social mobility has improved for the better because of the hard work to improve the life of my household. Even physically, I used to be very lanky but now I have put on some weight and command respect among my own family and the late husband's family as well. They sometimes see me as their "god" because of the way I have managed to improve in life out of the difficulty* [Asana].

Subsequently, and in addition to farming, she got some casual work cleaning and laboring, which enabled her to pay off the loans she took out to send her children back to school. She is now remarried and settled in Jirapa.

Looking over a longer duration, Maria used her extended family in Oshakati to train as a seamstress. Through her brother she managed to locate premises for her sewing business reasonably close to her family.

> *Perhaps if I didn't move away from home then things could have been bad and I could have suffered too. [I]f I couldn't move away from home then there could not be some infrastructures at home like the running water and the electricity because otherwise no one could get the income to bring some changes* [Maria].

She now works there and commutes back and forth to her family home. By diversifying her income sources, she has mitigated the worst impacts of drought periods and also survived shocks of a more personal nature, including the death of two of her brothers and her father. Despite these events, she has managed to improve her quality of life (illustrated through the provision of piped water and solar power for example) demonstrating the upwardly mobile nature of her livelihood trajectory.

In both cases, the mobility that Asana and Maria employ signifies the endemic and important role it plays within dryland livelihoods. For Asana and Maria, the shock of losing the support of male family members on their livelihoods did not appear to have a detrimental and long-lasting impact. This was in part due to the presence of supportive social networks (ability to move back in with family, having children live with other family members, or the support of brothers). As a result, both cases were able to increase their AOS and concurrently reduce their risk space, leaving them well placed to respond and cope with future challenges as and when they occur.

DISCUSSION

Contextual vulnerability interactions with the adaptation option space

Using the heuristic of the AOS, we explore the trajectories of people's lives by examining how they manage their risk and response space. Through this conceptualization, we foreground the role of more structural issues, through contextual vulnerability and changing risk profiles, which are often poorly captured within vulnerability and adaptation research (Tschakert et al. 2013, Thomas et al. 2019, Barrett et al. 2021). For example, when moving to Bangalore, Latha initially moved to an area that was prone to flooding. Such an example highlights how, despite moving, the vulnerability that people experience in one location can move with them, supporting similar findings in Latin America (Few et al. 2017, 2021a). Similarly, Makena, in moving to escape the threat of violence in the highlands in Kenya, relocated to an area that was facing ethnic conflict that ultimately resulted in the death of her husband. In these two cases, one set of risks are exchanged for another, highlighting the contextual, often chronic conditions that act to limit one's AOS and make the risk space particularly hard to manage.

Conversely, people reduce risks on an almost daily basis through autonomous, individual actions. This process of reducing risks

can challenge structures that are presented as immutable. For example, Sriram talks about how his caste identity, which was crippling in his village where the rural landowning caste holds the most power, is less of a barrier within the city of Bangalore. In Kenya, the vulnerability that two women (Makena and Hadiya) experienced in the highlands was substantially reduced by relocating to a settlement with a high proportion of female-headed households, because this reduced the threat of violence to them. Although the roles of caste and gender in mediating vulnerability and adaptation practices is increasingly recognized (Sultana 2014, Rao et al. 2020, Garcia et al. 2021), they are often addressed insubstantially or seen as a narrow binary rather than intersectional and relational (Carr and Thompson 2014, Tavenner and Crane 2019, Garcia et al. 2021, Boas et al. 2022).

Krishna (2010), in a cross-country study exploring people's movement into or out of poverty, discussed the interaction of more structural reasons with individual circumstances in explaining people's escape from or descend into poverty. Our analysis similarly highlights the strong links (constraints or opportunities) that exist between risks and adaptation decisions and contextual vulnerability. Through the cases, we show how various axes of differentiation, such as gender, caste, livelihood, or location, constrain opportunities differently for different people. In India, caste mediates the AOS, in Kenya gender played a key role, whereas in Ghana, patriarchal social norms were significant. Moreover, risks and vulnerabilities associated with apparently entrenched socio-structural conditions, such as caste, gender, and patriarchy, can be challenged in certain circumstances, questioning the assumption that people at the bottom of economic and social hierarchies lack agency to influence the wider structures that mediate the AOS (Rao et al. 2019, Deshingkar 2022).

Everyday mobilities

Mobility is typically viewed and understood in more bounded and dichotomous ways, delimited through specific temporal or spatial scales, such as labor migration, rural to urban migration, and transhumance (Wiederkehr et al. 2018). This bounded approach has two significant weaknesses. First, it excludes the more everyday mobilities that underpin people's livelihoods within drylands, and second, it abstracts one form of mobility from the other forms of mobility (occluding interrelations between the different forms) that are deployed to manage and respond to risks. Through the illustrative cases, we show that mobility is fluid and dynamic with people employing it in different ways depending on their needs (Hunter et al. 2015). Seeing mobility through the lens of the everyday helps to dissolve the categories through which mobility is often refracted and sheds light on the varied and important contributions smaller-scale spatial and temporal mobility plays for well-being.

Relatedly, the LH approach, and the greater power it provides the narrator to tell their own story, supports focusing adaptation on people's everyday lives and offers a counterpoint to the dominant and often apolitical and technocratic ways that adaptation is framed (Ayeb-Karlsson et al. 2016, Eriksen et al. 2021). The portrayal of mobility by the interviewees reveals its normalcy, reflecting its commonplace, yet central importance within lives and livelihoods and the very fluid way it is employed. This normalizing narrative contrasts the exceptionalism that frequently underpins discussions about mobility, particularly within literature on environmental change. Through this recentered view of adaptation and the challenge it poses to dominant framings of events and practices, we can shift the focus to more critical questions that have been of marginal influence on mainstream policy and practice (Ayeb-Karlsson et al. 2016). For instance, in India, promotion of borewells in our case study area is government policy, a specific technical solution to the (biophysical) problem of water scarcity, which helps to shift the focus away from the larger water footprint of urban areas or the role of the caste system in limiting opportunities for specific sections of the rural population (Singh 2021). In Kenya and Namibia, the focus on humanitarian relief during periods of drought is in sharp contrast to the neglected area of longer-term recovery despite its importance in promoting more a more stable AOS (Few et al. 2021b). Additionally, in Ghana, despite years of government programs and subsidies to smallholder farming communities in northern dryland areas to support irrigation and farming during the dry season, the relative economic inequalities of the north-south divide still persist.

Temporality in risk and response

We know that societies are socially differentiated and there is clearly a need for more refined and sensitive approaches that privilege heterogeneity, intersectionality, and situatedness when exploring the risks and stresses that characterize the lives of vulnerable people (Johansson and Vinthagen 2014, Rao et al. 2019). Furthermore, these socially-differentiated risks are experienced dynamically; populations are constantly responding to the changing environmental, social, political, economic, and cultural world around them (Krishna 2010, Fawcett et al. 2017, Thomas et al. 2019). To date, vulnerability and adaptation research has tended to conceptualize the risk and response space as static, with temporality poorly conceived and inadequately represented (Singh et al. 2019, Barrett et al. 2021) despite the knowledge that risks and responses are intimately linked and feedback on each other over time (Tschakert et al. 2013, Simpson et al. 2021). The value of temporally-sensitive approaches to exploring risks and responses is evident in the data on compounding shocks over time. In certain cases (Fuseini, Jilma, Ramesh, and Makena), compounding shocks result in a downward trajectory that is rapid and appears to offer minimal hope of recovery. Here, we see how people's AOS is influenced not only by their present actions but also by past behavior that ripples forward enabling and constraining subsequent decisions and options (Singh et al. 2021:91).

Understanding a person's trajectory and the conditions shaping this trajectory is important as it reveals whether the move is in a positive or negative direction, thereby offering a crucial advantage over more static approaches to understanding people's lives (Haddad and Frankenbeger 2003, West 2013). The constrained choices that the people experience, their contextual vulnerability, illustrate the challenges of recovery when the overall trajectory within one's life is negative (Rigg and Salamanca 2015, Otto et al. 2017). As the risk space expands and the response space contracts, the consequences for well-being become ever more irreversible, resulting in an increasingly unstable AOS. In these instances, the abilities of individuals are stifled to such an extent that it becomes increasingly impossible to reverse the downward trajectory without challenging the broader conditions that inhibit

effective responses (Deb and Haque 2011). In terms of interventions, knowledge about a trajectory and the nature of the risks and adaptation options available to a person or household also provides a good indication of the nature of interventions that are or are not likely to be required and thus effective (Grothmann and Patt 2005, Ford et al. 2010, Krishna 2010, Ayeb-Karlsson et al. 2016).

CONCLUSION

To understand the contexts that shape everyday mobilities and the outcomes these have on people and households over time, we followed a temporal approach, thereby moving away from more static forms of inquiry. Such an approach demonstrates that risks and responses change, and this widening and narrowing space that people negotiate is what we call the "adaptation option space." We offer this heuristic to demonstrate how risks and responses change over time, are embedded in people's contextual vulnerability, and, more crucially, how risks and responses interact to mediate how and why people adapt. Moreover, promisingly, we find that risks and vulnerabilities associated with apparently entrenched socio-structural conditions, such as caste, gender, and patriarchy, can be challenged in certain circumstances and help to explain why some people are able to adapt to change more successfully than others (Deshingkar 2022). Such insights force us to question the assumption that the poorest and more marginalized people lack the agency to influence wider structures that mediate the AOS.

Within the literature on mobility and environmental change, everyday mobility remains marginal to mainstream research and public discourse that tends to focus on more extraordinary, often one-time or international migration. That this form of mobility is under-researched is surprising, given its centrality to people's lives and livelihoods, and hence, clearly warrants more attention. Through the application of the everyday as an analytical lens we offer a counterpoint to some of the dominant framings that occupy adaptation science and seek to ground often abstract ideas and concepts within people's everyday practices. We show how the everyday offers scope to dismantle some of the oppositional binaries (such as normal versus exceptional), and explore what climate or environmental change means in practice and the sorts of responses that populations are enacting. In so doing, we stress that far from being exceptional, this everyday mobility is ubiquitous and much removed from alarmist discourses of "climate migration" that view movement as solely climate-driven and exceptional (Bettini and Gioli 2015, Bettini et al. 2017, Thalheimer et al. 2021). Instead, mobility is normalized within lives and livelihoods and these movements (sometimes mundane, sometimes more exceptional) are central to managing an evolving portfolio of risks, especially in the context of increasing climate variability.

Most mobility, especially that in which environmental change is of some influence, is and will remain "local." Focusing research and interventions here offers potential to positively impact on the lives and livelihoods of populations who reside in often marginal environments by targeting support that recognizes the general trajectory within one's life and the contextual vulnerability and risks within which the trajectory operates. For instance, if a household is on a positive trajectory, then support for enhancing livelihoods may be more important and have a greater positive impact on their well-being. Conversely, if a person is on a downward trajectory, then more foundational support addressing basic needs may be required to maintain an appropriate social floor. The challenge, and this is not to be underestimated, lies in identifying what trajectory people are on and ensuring that suitable resources and support are available.

Author Contributions:

Mark Tebboth: conceptualization, methodology, formal analysis, investigation, writing (original draft, writing), review & editing, funding acquisition; Chandni Singh: conceptualization, methodology, formal analysis, investigation, writing (original draft, writing), review & editing; Dian Spear: formal analysis, investigation, writing (original draft); Adelina Mensah: formal analysis, investigation, writing (original draft); Prince Ansah: formal analysis, investigation, writing (original draft)

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Data Availability:

Data/code sharing is not applicable to this article because no data/code were analyzed in this study that can be shared without breaching confidentiality and anonymity agreements of the interviewees.

LITERATURE CITED

Adger, W. N. 2003. Social capital, collective action, and adaptation to climate change. Economic Geography 79:387-404. https://doi.org/10.1111/j.1944-8287.2003.tb00220.x

Adger, W. N., S. Huq, K. Brown, D. Conway, and M. Hulme. 2003. Adaptation to climate change in the developing world. Progress in Development Studies 3:179-195. https://doi.org/10.1191/1464993403ps060oa

Ansell, N., F. Hajdu, L. van Blerk, and E. Robson. 2014. Reconceptualising temporality in young lives: exploring young people's current and future livelihoods in AIDS-affected southern Africa. Transactions of the Institute of British Geographers 39:387-401. https://doi.org/10.1111/tran.12041

Artur, L., and D. Hilhorst. 2012. Everyday realities of climate change adaptation in Mozambique. Global Environmental Change 22:529-536. https://doi.org/10.1016/j.gloenvcha.2011.11.013

Ayeb-Karlsson, S. 2020. 'I do not like her going to the shelter': stories on gendered disaster (im)mobility and well-being loss in coastal Bangladesh. International Journal of Disaster Risk Reduction 50:101904. https://doi.org/10.1016/j.ijdrr.2020.101904

Ayeb-Karlsson, S., K. van der Geest, I. Ahmed, S. Huq, and K. Warner. 2016. A people-centred perspective on climate change, environmental stress, and livelihood resilience in Bangladesh. Sustainability Science 11:679-694. https://doi.org/10.1007/s11625-016-0379-z

Bakewell, O. 2010. Some reflections on structure and agency in migration theory. Journal of Ethnic and Migration Studies 36:1689-1708. https://doi.org/10.1080/1369183X.2010.489382

Barbieri, A. F., E. Domingues, B. L. Queiroz, R. M. Ruiz, J. I. Rigotti, J. A. M. Carvalho, and M. F. Resende. 2010. Climate change and population migration in Brazil's Northeast: scenarios for 2025–2050. Population and Environment 31:344-370. https://doi.org/https://doi.org/10.1007/s11111-010-0105-1

Bardsley, D. K., and G. J. Hugo. 2010. Migration and climate change: examining thresholds of change to guide effective adaptation decision-making. Population and Environment 32:238-262. https://doi.org/10.1007/s11111-010-0126-9

Barrett, C. B., K. Ghezzi-Kopel, J. Hoddinott, N. Homami, E. Tennant, J. Upton, and T. Wu. 2021. A scoping review of the development resilience literature: theory, methods and evidence. World Development 146:105612. https://doi.org/10.1016/j.worlddev.2021.105612

Bettini, G., and G. Gioli. 2015. Waltz with development: insights on the developmentalization of climate-induced migration. Migration and Development 5:171-189. https://doi.org/10.1080/21632324.2015.1096143

Bettini, G., S. L. Nash, and G. Gioli. 2017. One step forward, two steps back? The fading contours of (in)justice in competing discourses on climate migration. Geographical Journal 183:348-358. https://doi.org/10.1111/geoj.12192

Bilsborrow, R. E., and S. J. F. Henry. 2012. The use of survey data to study migration-environment relationships in developing countries: alternative approaches to data collection. Population and Environment 34:113-141. https://doi.org/10.1007/s11111-012-0177-1

Black, R., D. Kniveton, R. Skeldon, D. Coppard, A. Murata, and K. Schmidt-Verkerk. 2008. Demographics and climate change: future trends and their policy implications for migration. Development Research Centre on Migration, Globalisation and Poverty, University of Sussex, Brighton, UK.

Blaikie, P., T. Cannon, I. Davis, and B. Wisner. 2004. At risk: natural hazards, people's vulnerability and disasters, second edition. Routledge, London, UK.

Boas, I., N. de Pater, and B. T. Furlong. 2022. Moving beyond stereotypes: the role of gender in the environmental change and human mobility nexus. Climate and Development. https://doi.org/10.1080/17565529.2022.2032565

Boas, I., C. Farbotko, H. Adams, H. Sterly, S. Bush, K. van der Geest, H. Wiegel, H. Ashraf, A. Baldwin, G. Bettini, S. Blondin, M. de Bruijn, D. Durand-Delacre, C. Fröhlich, G. Gioli, L. Guaita, E. Hut, F. X. Jarawura, M. Lamers, S. Lietaer, S. L. Nash, E. Piguet, D. Rothe, P. Sakdapolrak, L. Smith, B. T. Furlong, E. Turhan, J. Warner, C. Zickgraf, R. Black, and M. Hulme. 2019. Climate migration myths. Nature Climate Change 9:901-903. https://doi.org/10.1038/s41558-019-0633-3

Borderon, M., P. Sakdapolrak, R. Muttarak, E. Kebede, R. Pagogna, and E. Sporer. 2019. Migration influenced by environmental change in Africa: a systematic review of empirical evidence. Demographic Research 41:491-544 pp. https://doi.org/10.4054/DemRes.2019.41.18

Brace, C., and H. Geoghegan. 2010. Human geographies of climate change: landscape, temporality, and lay knowledges. Progress in Human Geography 35:284-302. https://doi.org/10.1177/0309132510376259

Brooks, N. 2003. Vulnerability, risk and adaptation: a conceptual framework. Tyndall centre working paper no. 38. Tyndall Centre for Climate Change Research and Centre for Social and Economic Research on the Global Environment (CSERGE), Norwich, UK.

Camfield, L., J. Leavy, S. Endale, and T. Tefera. 2020. People who once had 40 cattle are left only with fences: coping with persistent drought in Awash, Ethiopia. European Journal of Development Research 32:889-905. https://doi.org/10.1057/s41287-019-00245-z

Carabine, E., M.-A. Jouanjean, and J. Tsui. 2015. Kenya ending drought emergencies policy review: scenarios for building resilience in the ASALS. Report prepared by the Technical Consortium, a project of the CGIAR. Technical report series no. 2: strengthening the evidence base for resilience in the Horn of Africa. International Livestock Research Institute (ILRI), Nairobi, Kenya.

Carr, E. R., and M. C. Thompson. 2014. Gender and climate change adaptation in agrarian settings: current thinking, new directions, and research frontiers. Geography Compass 8:182-197. https://doi.org/10.1111/gec3.12121

Catley, A., and Y. Aklilu. 2013. Moving up or moving out? Commercialization, growth and destitution in pastoral areas. Pages 85-97 in A. Catley, J. Lind, and I. Scoones, editors. Pastoralism and development in Africa: dynamic change at the margins. Routledge, London, UK. https://doi.org/https://doi.org/10.4324/9780203105979-9

Catley, A., J. Lind, and I. Scoones, editors. 2013. Pastoralism and development in Africa: dynamic change at the margins. Routledge, London, UK. https://doi.org/10.4324/9780203105979

Cattaneo, A., and S. Robinson. 2020. Multiple moves and return migration within developing countries: a comparative analysis. Population, Space and Place 26:e2335. https://doi.org/10.1002/psp.2335

Cervigni, R., M. Morris, P. Fallavier, Z. Guo, B. Boehlert, and K. Strzepek. 2016b. Vulnerability in drylands tomorrow: business as usual raising ominous prospects. Pages 65-73 in R. Cervigni, and M. Morris, editors. Confronting drought in Africa's drylands: opportunities for enhancing resilience. World Bank, Washington, D.C., USA. https://doi.org/10.1596/978-1-4648-0817-3_ch4

Cervigni, R., M. Morris, P. Scandizzo, S. Savastano, A. Paolantonio, F. Alfani, A. Zezza, Z. Guo, M. D'errico, R. Biancalani, S. Bunning, M. Petri, M. Manssouri, C. Kerven, and R. Behnke. 2016a. Vulnerability in the drylands today. Pages 49-34 in R. Cervigni, R. Cervigni, and M. Morris, editors. Confronting drought in Africa's drylands: opportunities for enhancing resilience. World Bank, Washington, D.C., USA. https://doi.org/10.1596/978-1-4648-0817-3_ch3

Cundill, G., C. Singh, W. N. Adger, R. Safra de Campos, K. Vincent, M. Tebboth, and A. Maharjan. 2021. Toward a climate mobilities research agenda: intersectionality, immobility, and policy responses. Global Environmental Change 69:102315. https://doi.org/10.1016/j.gloenvcha.2021.102315

Davies, J., C. Singh, M. Tebboth, D. Spear, A. Mensah, and P. Ansah. 2018. Conducting life history interviews: a how-to guide. Collaborative Adapation Research Initiative in Africa and Asia (CARIAA), Cape Town, South Africa.

Davis, K. F., A. Bhattachan, P. D'Odorico, and S. Suweis. 2018. A Universal model for predicting human migration under climate change: examining future sea level rise in Bangladesh. Environmental Research Letters 13:064030. https://doi.org/10.1088/1748-9326/aac4d4

de Haan, C., T. Robinson, G. Conchedda, P. Ericksen, M. Said, L. Robinson, F. Flintan, A. Shaw, S. Kifugo, A. Wane, I. Touré, A. Ickowicz, C. Corniaux, J. Barr, C. Martignac, A. Mude, R. Cervigni, M. Morris, A. Mottet, P. Gerber, S. Msangi, M. Lesnoff, F. Ham, E. Filliol, K. Nigussie, A. Paolantonio, and F. Alfani. 2016. Livestock production systems: seizing the opportunities for pastoralists and agro-pastoralists. Pages 47-70 in R. Cervigni, and M. Morris, editors. Confronting drought in Africa's drylands: opportunities for enhancing resilience. World Bank, Washington, D.C., USA. https://doi.org/10.1596/978-1-4648-0817-3_ch5

de Sherbinin, A., M. Levy, S. Adamo, K. MacManus, G. Yetman, V. Mara, L. Razafindrazay, B. Goodrich, T. Srebotnjak, C. Aichele, and L. Pistolesi. 2012. Migration and risk: net migration in marginal ecosystems and hazardous areas. Environmental Research Letters 7:045602. https://doi.org/10.1088/1748-9326/7/4/045602

Deb, A. K., and C. E. Haque. 2011. 'Sufferings start from the mothers' womb': vulnerabilities and livelihood war of the small-scale fishers of Bangladesh. Sustainability 3:2500-2527. https://doi.org/10.3390/su3122500

Deshingkar, P. 2022. Cultural capital and constrained agency in debt-migration for construction work in India. Cultural Studies. https://doi.org/10.1080/09502386.2022.2045333

Diedhiou, A., A. Bichet, R. Wartenburger, S. I. Seneviratne, D. P. Rowell, M. B. Sylla, I. Diallo, S. Todzo, N. D. E. Touré, M. Camara, B. N. Ngatchah, N. A. Kane, L. Tall, and F. Affholder. 2018. Changes in climate extremes over West and Central Africa at 1.5 °C and 2 °C global warming. Environmental Research Letters 13:065020. https://doi.org/https://doi.org/10.1088/1748-9326/aac3e5

Dow, K., F. Berkhout, B. L. Preston, R. J. T. Klein, G. Midgley, and M. R. Shaw. 2013. Limits to adaptation. Nature Climate Change 3:305-307. https://doi.org/10.1038/nclimate1847

Duvernoy, R. 2020. Climate change and the everyday: becoming present to precarity. Ethics & the Environment 25:73-95. https://doi.org/10.2979/ethicsenviro.25.2.04

Eklund, L., C. Romankiewicz, M. Brandt, M. Doevenspeck, and C. Samimi. 2016. Data and methods in the environment-migration nexus: a scale perspective. DIE ERDE - Journal of the Geographical Society of Berlin 147:139-152.

Ellison, J. C. 2015. Vulnerability assessment of mangroves to climate change and sea-level rise impacts. Wetlands Ecology and Management 23:115-137. https://doi.org/10.1007/s11273-014-9397-8

Entwisle, B., N. E. Williams, A. M. Verdery, R. R. Rindfuss, S. J. Walsh, G. P. Malanson, P. J. Mucha, B. G. Frizzelle, P. M. McDaniel, X. Yao, B. W. Heumann, P. Prasartkul, Y. Sawangdee, and A. Jampaklay. 2016. Climate shocks and migration: an agent-based modeling approach. Population and Environment 38:47-71. https://doi.org/10.1007/s11111-016-0254-y

Eriksen, S., E. L. F. Schipper, M. Scoville-Simonds, K. Vincent, H. N. Adam, N. Brooks, B. Harding, D. Khatri, L. Lenaerts, D. Liverman, M. Mills-Novoa, M. Mosberg, S. Movik, B. Muok, A. Nightingale, H. Ojha, L. Sygna, M. Taylor, C. Vogel, and J. J. West. 2021. Adaptation interventions and their effect on vulnerability in developing countries: help, hindrance or irrelevance? World Development 141:105383. https://doi.org/10.1016/j.worlddev.2020.105383

Etzold, B. 2016. Migration, informal labour and (trans) local productions of urban space - the case of Dhaka's street food vendors. Population, Space and Place 22:170-184. https://doi.org/10.1002/psp.1893

Farbotko, C., C. McMichael, O. Dun, H. Ransan-Cooper, K. E. McNamara, and F. Thornton. 2018. Transformative mobilities in the Pacific: promoting adaptation and development in a changing climate. Asia & the Pacific Policy Studies 5:393-407. https://doi.org/10.1002/app5.254

Fawcett, D., T. Pearce, J. D. Ford, and L. Archer. 2017. Operationalizing longitudinal approaches to climate change vulnerability assessment. Global Environmental Change 45:79-88. https://doi.org/10.1016/j.gloenvcha.2017.05.002

Feng, S. Z., A. B. Krueger, and M. Oppenheimer. 2010. Linkages among climate change, crop yields and Mexico-US cross-border migration. Proceedings of the National Academy of Sciences 107:14257-14262. https://doi.org/10.1073/pnas.1002632107

Few, R., M. T. Armijos, and J. Barclay. 2017. Living with Volcan Tungurahua: the dynamics of vulnerability during prolonged volcanic activity. Geoforum 80:72-81. https://doi.org/10.1016/j.geoforum.2017.01.006

Few, R., H. Marsh, G. Jain, C. Singh, and M. G. L. Tebboth. 2021b. Representing recovery: how the construction and contestation of needs and priorities can shape long-term outcomes for disaster-affected people. Progress in Development Studies 21:7-25. https://doi.org/10.1177/1464993420980939

Few, R., V. Ramírez, M. T. Armijos, L. A. Z. Hernández, and H. Marsh. 2021a. Moving with risk: forced displacement and vulnerability to hazards in Colombia. World Development 144:105482. https://doi.org/10.1016/j.worlddev.2021.105482

Findlay, A. M. 2011. Migrant destinations in an era of environmental change. Global Environmental Change 21:S50-S58. https://doi.org/10.1016/j.gloenvcha.2011.09.004

Ford, J. D., E. C. H. Keskitalo, T. Smith, T. Pearce, L. Berrang-Ford, F. Duerden, and B. Smit. 2010. Case study and analogue methodologies in climate change vulnerability research. WIREs Climate Change 1:374-392. https://doi.org/10.1002/wcc.48

Ford, J. D., T. Pearce, G. McDowell, L. Berrang-Ford, J. S. Sayles, and E. Belfer. 2018. Vulnerability and its discontents: the past, present, and future of climate change vulnerability research. Climatic Change 151:189-203. https://doi.org/10.1007/s10584-018-2304-1

Forsyth, T. 2003. Critical political ecology: the politics of environmental science. Routledge, London, UK. https://doi.org/10.4324/9780203017562

Funder, M., and C. E. Mweemba. 2019. Interface bureaucrats and the everyday remaking of climate interventions: evidence from climate change adaptation in Zambia. Global Environmental Change 55:130-138. https://doi.org/10.1016/j.gloenvcha.2019.02.007

Fussell, E., L. M. Hunter, and C. L. Gray. 2014. Measuring the environmental dimensions of human migration: the demographer's toolkit. Global Environmental Change 28:182-191. https://doi.org/10.1016/j.gloenvcha.2014.07.001

Fussell, E., N. Sastry, and M. VanLandingham. 2010. Race, socioeconomic status, and return migration to New Orleans after Hurricane Katrina. Population and Environment 31:20-42. https://doi.org/10.1007/s11111-009-0092-2

Füssel, H.-M., and R. J. T. Klein. 2006. Climate change vulnerability assessments: an evolution of conceptual thinking. Climatic Change 75:301-329. https://doi.org/10.1007/s10584-006-0329-3

Gajjar, S. P., C. Singh, and T. Deshpande. 2018. Tracing back to move ahead: a review of development pathways that constrain adaptation futures. Climate and Development 11:223-237. https://doi.org/10.1080/17565529.2018.1442793

Garcia, A., P. Tschakert, N. A. Karikari, S. Mariwah, and M. Bosompem. 2021. Emancipatory spaces: opportunities for (re) negotiating gendered subjectivities and enhancing adaptive capacities. Geoforum 119:190-205. https://doi.org/10.1016/j.geoforum.2020.09.018

Giupponi, C., and C. Biscaro. 2015. Vulnerabilities—bibliometric analysis and literature review of evolving concepts. Environmental Research Letters 10:123002. https://doi.org/10.1088/1748-9326/10/12/123002

Gongbuzeren, Z., L. Wenjun, and L. Yupei. 2021. The role of community cooperative institutions in building rural-urban linkages under urbanization of pastoral regions in China. Frontiers in Sustainable Food Systems 5:612207. https://doi.org/10.3389/fsufs.2021.612207

Goodall, S. K. 2004. Rural-to-urban migration and urbanization in Leh, Ladakh. Mountain Research and Development 24:220-227. https://doi.org/10.1659/0276-4741(2004)024[0220:RMAUIL]2.0.CO;2

Grace, K., V. Hertrich, D. Singare, and G. Husak. 2018. Examining rural Sahelian out-migration in the context of climate change: an analysis of the linkages between rainfall and out-migration in two Malian villages from 1981 to 2009. World Development 109:187-196. https://doi.org/10.1016/j.worlddev.2018.04.009

Gray, C., and R. Bilsborrow. 2010. Environmental influences on migration in rural Ecuador. Demography 50:1217-1241. https://doi.org/10.1007/s13524-012-0192-y

Gray, C., and V. Mueller. 2012. Natural disasters and population mobility in Bangladesh. Proceedings of the National Academy of Sciences 109:6000-6005. https://doi.org/10.1073/pnas.1115944109

Greiner, C. 2016. Land-use change, territorial restructuring, and economies of anticipation in dryland Kenya. Journal of Eastern African Studies 10:530-547. https://doi.org/10.1080/17531055.2016.1266197

Grothmann, T., and A. Patt. 2005. Adaptive capacity and human cognition: the process of individual adaptation to climate change. Global Environmental Change 15:199-213. https://doi.org/10.1016/j.gloenvcha.2005.01.002

Guidi, C., G. Di Matteo, and S. Grego. 2018. An overview of proven climate change vulnerability assessment tools for forests and forest-dependent communities across the globe: a literature analysis. Journal of Forestry Research 29:1167-1175. https://doi.org/10.1007/s11676-018-0611-z

Gunderson, L. H., and C. S. Holling, editors. 2002. Panarchy: Understanding Transformations in Human and Natural Systems. Island Press, Washington, D.C., USA.

Haasnoot, M., R. Biesbroek, J. Lawrence, V. Muccione, R. Lempert, and B. Glavovic. 2020. Defining the solution space to accelerate climate change adaptation. Regional Environmental Change 20:37. https://doi.org/10.1007/s10113-020-01623-8

Haddad, L., and T. Frankenbeger. 2003. Integrating relief and development to accelerate reductions in food insecurity in shock-prone areas. Food and Nutrition Technical Assistance Project, Academy for Educational Development, Washington, D.C., USA.

Hallegatte, S. 2009. Strategies to adapt to an uncertain climate change. Global Environmental Change 19:240-247. https://doi.org/10.1016/j.gloenvcha.2008.12.003

Henry, S. J. F., and S. Dos Santos. 2013. Rainfall variations and child mortality in the Sahel: results from a comparative event history analysis in Burkina Faso and Mali. Population and Environment 34:431-459. https://doi.org/10.1007/s11111-012-0174-4

Henry, S., V. Piché, D. Ouédraogo, and E. F. Lambin. 2004a. Descriptive analysis of the individual migratory pathways according to environmental typologies. Population and Environment 25:397-422. https://doi.org/10.1023/B:POEN.0000036929.19001.a4

Henry, S., B. Schoumaker, and C. Beauchemin. 2004b. The impact of rainfall on the first out-migration: a multi-level event-history analysis in Burkina Faso. Population and Environment 25:423-460. https://doi.org/10.1023/B:POEN.0000036928.17696.e8

Holland, J., and R. Thomson. 2009. Gaining perspective on choice and fate. European Societies 11:451-469. https://doi.org/10.1080/14616690902764799

Hornidge, A.-K., and F. Scholtes. 2011. Climate change and everyday life in Toineke Village, West Timor: uncertainties, knowledge and adaptation. Sociologus 61:151-175. https://doi.org/10.3790/soc.61.2.151

Huang, J., M. Ji, Y. Xie, S. Wang, Y. He, and J. Ran. 2016. Global semi-arid climate change over last 60 years. Climate Dynamics 46:1131-1150. https://doi.org/10.1007/s00382-015-2636-8

Hulme, M. 2009. Why we disagree about climate change: understanding controversy, inaction and opportunity. Cambridge University Press, Cambridge, UK. https://doi.org/10.1017/CBO9780511841200

Hunter, L. M., J. K. Luna, and R. M. Norton. 2015. Environmental dimensions of migration. Annual Review of Sociology 41:377-397. https://doi.org/10.1146/annurev-soc-073014-112223

Hunter, L. M., S. Murray, and F. Riosmena. 2013. Rainfall patterns and U.S. migration from rural Mexico. International Migration Review 47:874-909. https://doi.org/10.1111/imre.12051

Intergovernmental Panel for Climate Change (IPCC). 2020. Summary for Policymakers. Pages 1-36 in P. R. Shukla, J. Skeg, E. Calvo Buendia, V. Masson-Delmotte, H.-O. Pörtner, D. C. Roberts, P. Zhai, R. Slade, S. Connors, R. van Diemen, M. Ferrat, E. Haughey, S. Luz, M. Pathak, J. Petzold, J. Portugal Pereira, P. Vyas, E. Huntley, K. Kissick, M. Belkacemi, and J. Malley, editors. Climate change and land: an ipcc special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems. IPCC, Cambridge University Press, Cambridge, UK.https://doi.org/10.1017/9781009157988.001

International Livestock Research Institute (ILRI), International Union for Conservation of Nature (IUCN), The Food and Agriculture Organization of the United Nations (FAO), World Wide Fund for Nature (WWF), the UN Environment Programme (UNEP), and International Land Coalition (ILC). 2021. The rangeland atlas. ILRI, Nairobi, Kenya.

Joakim, E. P., L. Mortsch, and G. Oulahen. 2015. Using vulnerability and resilience concepts to advance climate change adaptation. Environmental Hazards 14:137-155. https://doi.org/10.4324/9781003171430-1

Johansson, A., and S. Vinthagen. 2014. Dimensions of everyday resistance: an analytical framework. Critical Sociology 42:417-435. https://doi.org/10.1177/0896920514524604

Jurgilevich, A., A. Räsänen, F. Groundstroem, and S. Juhola. 2017. A systematic review of dynamics in climate risk and vulnerability assessments. Environmental Research Letters 12:013002. https://doi.org/10.1088/1748-9326/aa5508

Kniveton, D., K. Schmidt-Verkerk, C. Smith, and R. Black. 2008. Climate change and migration: improving methodologies to estimate flows. International Organization for Migration, Genva, Switzerland.. https://doi.org/10.18356/6233a4b6-en

Kniveton, D., C. Smith, and S. Wood. 2011. Agent-based model simulations of future changes in migration flows for Burkina Faso. Global Environmental Change 21:S34-S40. https://doi.org/10.1016/j.gloenvcha.2011.09.006

Kothari, U., and A. Arnall. 2019. Everyday life and environmental change. Geographical Journal 185:130-141. https://doi.org/10.1111/geoj.12296

Krishna, A. 2010. Who became poor, who escaped poverty, and why? Developing and using a retrospective methodology in five countries. Journal of Policy Analysis and Management 29:351-372. https://doi.org/10.1002/pam.20495

Langevang, T. 2008. 'We are managing!' Uncertain paths to respectable adulthoods in Accra, Ghana. Geoforum 39:2039-2047. https://doi.org/10.1016/j.geoforum.2008.09.003

Liao, C., A. Agrawal, P. E. Clark, S. A. Levin, and D. I. Rubenstein. 2020. Landscape sustainability science in the drylands: mobility, rangelands and livelihoods. Landscape Ecology 35:2433-2447. https://doi.org/10.1007/s10980-020-01068-8

Maharjan, A., R. S. de Campos, C. Singh, S. Das, A. Srinivas, M. R. A. Bhuiyan, S. Ishaq, M. A. Umar, T. Dilshad, K. Shrestha, S. Bhadwal, T. Ghosh, N. Suckall, and K. Vincent. 2020. Migration and household adaptation in climate-sensitive hotspots in South Asia. Current Climate Change Reports 6:1-16. https://doi.org/10.1007/s40641-020-00153-z

McLeman, R. 2013. Developments in modelling of climate change-related migration. Climatic Change 117:599-611. https://doi.org/10.1007/s10584-012-0578-2

Mganga, K. Z., N. K. R. Musimba, and D. M. Nyariki. 2015. Combining sustainable land management technologies to combat land degradation and improve rural livelihoods in semi-arid lands in Kenya. Environmental Management 56:1538-1548. https://doi.org/10.1007/s00267-015-0579-9

Mosley, J., and E. E. Watson. 2016. Frontier transformations: development visions, spaces and processes in Northern Kenya and Southern Ethiopia. Journal of Eastern African Studies 10:452-475. https://doi.org/10.1080/17531055.2016.1266199

Neumann, K., and F. Hermans. 2015. What drives human migration in Sahelian countries? A meta-analysis. Population Space and Place 23:e1962. https://doi.org/10.1002/psp.1962

New, M. 2018. What latest assessment on global warming means for southern Africa. The Conversation, Environment + Energy, 9 October. https://theconversation.com/what-latest-assessment-on-global-warming-means-for-southern-africa-104644

Nicholls, R. J., R. S. J. Tol, and A. T. Vafeidis. 2008. Global estimates of the impact of a collapse of the West Antarctic ice sheet: an application of *FUND*. Climatic Change 91:171-191. https://doi.org/10.1007/s10584-008-9424-y

Nyberg, G., P. Knutsson, M. Ostwald, I. Öborn, E. Wredle, D. J. Otieno, S. Mureithi, P. Mwangi, M. Y. Said, M. Jirström, A. Grönvall, J. Wernersson, S. Svanlund, L. Saxer, L. Geutjes, V. Karmebäck, J. N. Wairore, R. Wambui, J. De Leeuw, and A. Malmer. 2015. Enclosures in West Pokot, Kenya: transforming land, livestock and livelihoods in drylands. Pastoralism 5:25. https://doi.org/10.1186/s13570-015-0044-7

Oppermann, E., Y. Strengers, C. Maller, L. Rickards, and M. Brearley. 2018. Beyond threshold approaches to extreme heat: repositioning adaptation as everyday practice. Weather Climate and Society 10:885-898. https://doi.org/10.1175/WCAS-D-17-0084.1

Osbahr, H., C. Twyman, W. N. Adger, and D. S. G. Thomas. 2010. Evaluating successful livelihood adaptation to climate variability and change in Southern Africa. Ecology and Society 15(2):27. https://doi.org/10.5751/ES-03388-150227

Osima, S., V. S. Indasi, M. Zaroug, H. S. Endris, M. Gudoshava, H. O. Misiani, A. Nimusiima, R. O. Anyah, G. Otieno, B. A. Ogwang, S. Jain, A. L. Kondowe, E. Mwangi, C. Lennard, G. Nikulin, and A. Dosio. 2018. Projected climate over the Greater Horn of Africa under 1.5 °C and 2 °C global warming. Environmental Research Letters 13:065004. https://doi.org/https://doi.org/10.1088/1748-9326/aaba1b

Otto, I. M., D. Reckien, C. P. O. Reyer, R. Marcus, V. Le Masson, L. Jones, A. Norton, and O. Serdeczny. 2017. Social vulnerability to climate change: a review of concepts and evidence. Regional Environmental Change 17:1651-1662. https://doi.org/10.1007/s10113-017-1105-9

Parsons, L. 2017. Multi-scalar inequality: structured mobility and the narrative construction of scale in translocal Cambodia. Geoforum 85:187-196. https://doi.org/10.1016/j.geoforum.2017.07.027

Pelling, M., K. O'Brien, and D. Matyas. 2015. Adaptation and transformation. Climatic Change 133:113-127. https://doi.org/10.1007/s10584-014-1303-0

Piguet, E., R. Kaenzig, and J. Guélat. 2018. The uneven geography of research on "environmental migration". Population and Environment 39: 357-383. https://doi.org/10.1007/s11111-018-0296-4

Piguet, E., A. Pécoud, and P. de Guchteneire. 2011. Migration and climate change: an overview. Refugee Survey Quarterly 3:1-23. https://doi.org/10.1093/rsq/hdr006

Porter, G., K. Hampshire, A. Abane, A. Tanle, K. Esia-Donkoh, R. O. Amoako-Sakyi, S. Agblorti and S. A. Owusu 2011. Mobility, education and livelihood trajectories for young people in rural Ghana: a gender perspective. Children's Geographies 9:395-410. https://doi.org/10.1080/14733285.2011.590705

Porter, G., K. Hampshire, M. Mashiri, S. Dube, and G. Maponya. 2010. 'Youthscapes' and escapes in rural Africa: education, mobility and livelihood trajectories for young people in Eastern Cape, South Africa. Journal of International Development 22:1090-1101. https://doi.org/10.1002/jid.1748

Prăvălie, R. 2016. Drylands extent and environmental issues. A global approach. Earth-Science Reviews 161:259-278. https://doi.org/https://doi.org/10.1016/j.earscirev.2016.08.003

Ramarao, M. V. S., J. Sanjay, R. Krishnan, M. Mujumdar, A. Bazaz, and A. Revi. 2019. On observed aridity changes over the semiarid regions of India in a warming climate. Theoretical and Applied Climatology 136:693-702. https://doi.org/10.1007/s00704-018-2513-6

Rao, N., E. T. Lawson, W. N. Raditloaneng, D. Solomon, and M. N. Angula. 2019. Gendered vulnerabilities to climate change: insights from the semi-arid regions of Africa and Asia. Climate and Development 11:14-26. https://doi.org/10.1080/17565529.2-017.1372266

Rao, N., C. Singh, D. Solomon, L. Camfield, R. Sidiki, M. Angula, P. Poonacha, A. Sidibé, and E. T. Lawson. 2020. Managing risk, changing aspirations and household dynamics: implications for well-being and adaptation in semi-arid Africa and India. World Development 125:104667. https://doi.org/10.1016/j.worlddev.2019.104667

Räsänen, A., S. Juhola, A. Nygren, M. Käkönen, M. Kallio, A. M. Monge and M. Kanninen 2016. Climate change, multiple stressors and human vulnerability: a systematic review. Regional Environmental Change 16:2291-2302. https://doi.org/10.1007/s10113-016-0974-7

Reid, R. S., M. E. Fernández-Giménez, and K. A. Galvin. 2014. Dynamics and resilience of rangelands and pastoral peoples around the globe. Annual Review of Environment and Resources 39:217-242. https://doi.org/10.1146/annurev-environ-020713-163329

Reynolds, J. F., D. M. S. Smith, E. F. Lambin, B. L. Turner II, M. Mortimore, S. P. J. Batterbury, T. E. Downing, H. Dowlatabadi, R. J. Fernández, J. E. Herrick, E. Huber-Sannwald, H. Jiang, R. Leemans, T. Lynam, F. T. Maestre, M. Ayarza, and B. Walker. 2007. Global desertification: building a science for dryland development. Science 316:847-851. https://doi.org/10.1126/science.1131634

Ribot, J. 2010. Vulnerability does not just fall from the sky: toward multiscale, pro-poor climate policy. Pages 47-74 in R. Mearns, and A. Norton, editors. Social dimensions of climate change: equity and vulnerability in a warming world. International Bank for Reconstruction and Development/World Bank, Washington, D.C., USA. https://doi.org/10.4337/9780857939111.00016

Ribot, J. 2014. Cause and response: vulnerability and climate in the Anthropocene. Journal of Peasant Studies 41:667-705. https://doi.org/10.1080/03066150.2014.894911

Rigaud, K. K., A. de Sherbinin, B. Jones, J. Bergmann, V. Clement, K. Ober, J. Schewe, S. Adamo, B. McCusker, S. Heuser, and A. Midgley. 2018. Groundswell: preparing for internal climate migration. World Bank, Washington, D.C., USA.

Rigg, J., and A. Salamanca. 2015. The devil in the detail: interpreting livelihood turbulence from a 25-year panel study from Thailand. Area 47:296-304. https://doi.org/10.1111/area.12188

Schimel, D. S. 2010. Drylands in the earth system. Science 327:418-419. https://doi.org/10.1126/science.1184946

Schipper, E. L. F. 2020. Maladaptation: when adaptation to climate change goes very wrong. One Earth 3:409-414. https://doi.org/10.1016/j.oneear.2020.09.014

Schofield, D., and F. Gubbels. 2019. Informing notions of climate change adaptation: a case study of everyday gendered realities of climate change adaptation in an informal settlement in Dar es Salaam. Environment and Urbanization 31:93-114. https://doi.org/10.1177/0956247819830074

Shackleton, S., G. Ziervogel, S. Sallu, T. Gill, and P. Tschakert. 2015. Why is socially-just climate change adaptation in sub-Saharan Africa so challenging? A review of barriers identified from empirical cases. WIREs Climate Change 6:321-344. https://doi.org/10.1002/wcc.335

Shukla, R., A. Chakraborty, and P. K. Joshi. 2017. Vulnerability of agro-ecological zones in India under the earth system climate

model scenarios. Mitigation and Adaptation Strategies for Global Change 22:399-425. https://doi.org/10.1007/s11027-015-9677-5

Sietz, D., M. K. B. Lüdeke, and C. Walther. 2011. Categorisation of typical vulnerability patterns in global drylands. Global Environmental Change 21:431-440. https://doi.org/10.1016/j.gloenvcha.2010.11.005

Simpson, N. P., K. J. Mach, A. Constable, J. Hess, R. Hogarth, M. Howden, J. Lawrence, R. J. Lempert, V. Muccione, B. Mackey, M. G. New, B. O'Neill, F. Otto, H.-O. Pörtner, A. Reisinger, D. Roberts, D. N. Schmidt, S. Seneviratne, S. Strongin, M. van Aalst, E. Totin, and C. H. Trisos. 2021. A framework for complex climate change risk assessment. One Earth 4:489-501. https://doi.org/10.1016/j.oneear.2021.03.005

Singh, C. 2018. Using life histories to understand temporal vulnerability to climate change in highly dynamic contexts. SAGE Research Methods Cases Part 1. SAGE, London, UK. https://doi.org/10.4135/9781526440358

Singh, C. 2019. Migration as a driver of changing household structures: implications for local livelihoods and adaptation. Migration and Development 8:301-319. https://doi.org/10.1080/21632324.2019.1589073

Singh, C. 2021. Of borewells and bicycles: the gendered nature of water access in Karnataka, South India and its implications for local vulnerability. Pages 58-84 in A. Hans, N. Rao, A. Prakash, and A. Patel, editors. Engendering climate change: learnings from South Asia. Routledge India, New Delhi, India. https://doi.org/https://doi.org/10.4324/9781003142409-5

Singh, C., and R. Basu. 2019. Moving in and out of vulnerability: interrogating migration as an adaptation strategy along a rural-urban continuum in India. Geographical Journal 186:87-102. https://doi.org/10.1111/geoj.12328

Singh, C., P. Dorward, and H. Osbahr. 2016. Developing a holistic approach to the analysis of farmer decision-making: implications for adaptation policy and practice in developing countries. Land Use Policy 59:329-343. https://doi.org/10.1016/j.landusepol.2016.06.041

Singh, C., M. Tebboth, D. Spear, P. Ansah, and A. Mensah. 2019. Exploring methodological approaches to assess climate change vulnerability and adaptation: reflections from using life history approaches. Regional Environmental Change 19:2667-2682. https://doi.org/10.1007/s10113-019-01562-z

Singh, C., M. G. L. Tebboth, J. Arvind, and Y. Udupa. 2021. Representing disasters and long-term recovery: insights from Tamil Nadu. Recovery with Dignity Project, Bangalore, India. https://doi.org/10.24943/RDLRTN06.2021

Smith, C. D. 2014. Modelling migration futures: development and testing of the rainfalls agent-based migration model - Tanzania. Climate and Development 6:1-15. https://doi.org/10.1080/17565529.2013.872593

Stafford Smith, M., G. Bastin, and V. Chewings. 2011. Migration and global environmental change: future challenges and opportunities. Foresight: migration and global environmental change. Final project report. Government Office for Science, London, UK.

Stringer, L. C., M. S. Reed, L. Fleskens, R. J. Thomas, Q. B. Le, and T. Lala-Pritchard. 2017. A new dryland development paradigm grounded in empirical analysis of dryland systems science. Land Degradation & Development 28:1952-1961. https://doi.org/10.1002/ldr.2716

Sultana, F. 2014. Gendering climate change: geographical insights. Professional Geographer 66:372-381. https://doi.org/10.1080/00330124.2013.821730

Tavenner, K., and T. A. Crane. 2019. Beyond 'women and youth': applying intersectionality in agricultural research for development. Outlook on Agriculture 48:316-325. https://doi.org/10.1177/0030727019884334

Thalheimer, L., F. Otto, and S. Abele. 2021. Deciphering impacts and human responses to a changing climate in East Africa. Frontiers in Climate 3:692114. https://doi.org/10.3389/fclim.2021.692114

Thober, J., N. Schwarz, and K. Hermans. 2018. Agent-based modeling of environment-migration linkages: a review. Ecology and Society 23(2):41. https://doi.org/10.5751/ES-10200-230241

Thomas, K., R. D. Hardy, H. Lazrus, M. Mendez, B. Orlove, I. Rivera-Collazo, J. T. Roberts, M. Rockman, B. P. Warner, and R. Winthrop. 2019. Explaining differential vulnerability to climate change: a social science review. WIREs Climate Change 10:e565. https://doi.org/10.1002/wcc.565

Thompson-Hall, M., E. R. Carr, and U. Pascual. 2016. Enhancing and expanding intersectional research for climate change adaptation in agrarian settings. Ambio 45:373-382. https://doi.org/10.1007/s13280-016-0827-0

Thomson, R., R. Bell, J. Holland, S. Henderson, S. McGrellis, and S. Sharpe. 2002. Critical moments: choice, chance and opportunity in young people's narratives of transition. Sociology 36:335-354. https://doi.org/10.1177/0038038502036002006

Tschakert, P., B. van Oort, A. L. St. Clair, and A. LaMadrid. 2013. Inequality and transformation analyses: a complementary lens for addressing vulnerability to climate change. Climate and Development 5:340-350. https://doi.org/10.1080/17565529.2013.828583

Tucker, J., M. Daoud, N. Oates, R. Few, D. Conway, S. Mtisi, and S. Matheson. 2015. Social vulnerability in three high-poverty climate change hot spots: what does the climate change literature tell us? Regional Environmental Change 15:783-800. https://doi.org/https://doi.org/10.1007/s10113-014-0741-6

Warner, K. 2011. Environmental change and migration: methodological considerations from ground-breaking global survey. Population and Environment 33:3-27. https://doi.org/10.1007/s11111-011-0150-4

Warner, K., and T. Afifi. 2013. Where the rain falls: evidence from 8 countries on how vulnerable households use migration to manage the risk of rainfall variability and food insecurity. Climate and Development 6:1-17. https://doi.org/10.1080/17565529.2013.835707

Watson, E. E., H. H. Kochore, and B. H. Dabasso. 2016. Camels and climate resilience: adaptation in Northern Kenya. Human Ecology 44:701-713. https://doi.org/10.1007/s10745-016-9858-1

Watts, M. J., and H. G. Bohle. 1993. The space of vulnerability: the causal structure of hunger and famine. Progress in Human Geography 17:43-67. https://doi.org/10.1177/030913259301700103

Werners, S. E., R. M. Wise, J. R. A. Butler, E. Totin, and K. Vincent. 2021. Adaptation pathways: a review of approaches and a learning framework. Environmental Science & Policy 116:266-275. https://doi.org/10.1016/j.envsci.2020.11.003

West, C. T. 2013. Documenting livelihood trajectories in the context of development interventions in northern Burkina Faso. Journal of Political Ecology 20:342-360. https://doi.org/10.2458/v20i1.21750

Wiederkehr, C., M. Beckmann, and K. Hermans. 2018. Environmental change, adaptation strategies and the relevance of migration in Sub-Saharan drylands. Environmental Research Letters 13:113003. https://doi.org/10.1088/1748-9326/aae6de