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RESEARCH ARTICLE



“We are still here” climate change, gender and immobility in highly mobile Himalayan communities

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ABSTRACT

In this paper we ask: why do people in rural agrarian communities facing increasing migration pressures from changing climatic conditions, stay? We aim to understand why people stay, who stays, what are the impacts of migration on those who stay, and what are their needs for adaptation? We study a population of people who do not migrate from Himalayan communities of Uttarakhand, India, despite their livelihoods being already severely disrupted by climate change and high outmigration has led to abandoned so-called ‘ghost villages’. Semi-structured interviews ($n = 72$) were held with affected communities, experts, and policymakers. Results show that motivations for immobility are shaped by place attachment; place-based resource advantages; social milieu; dependence on subsistence agriculture and gender roles. We find that immobility experiences are differentiated by gender, age and in situ resources. Those who stay are negatively impacted by migration via loss of labour in agriculture, changes in population size and composition, loss of community, in addition to the negative impacts of climate change. Our results are likely relevant on a global scale, to other subsistence smallholder communities who stay despite increasing climate risks. These populations will need gender-sensitive support to adapt in place.

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Immobility; Climate change; migration; gender; subsistence agriculture; mountain communities; India

1. Introduction

It is now well established that climate change impacts increasingly reduce habitability, disrupts livelihood resources, and decreases household food security in poor agrarian communities around the world (IPCC, 2022, p. 1181). This in turn reduces options to adapt in place for the affected populations and accelerates the need to transition from agrarian rural livelihoods to livelihoods based on wage earning. This transition is increasingly accomplished by rural-urban migration (Adger et al., 2014; Black et al., 2011; Horton et al., 2021; IOM, 2017; Rigaud et al., 2018), thus adding climate change to already existing drivers of migration (IPCC, 2022, p. 1181).

The growing literature on climate change and migration predominantly focuses on either distilling the additional impact of climate change on already existing socio-economic drivers of migration, or estimating where, when, and how many people will migrate due to climate change in the future (Clement et al., 2021; Durand-Delacre et al., 2021; Rigaud et al., 2018; Schewel, 2020; Wiegel et al., 2019; Zickgraf, 2021).

However, many people whose livelihoods are already severely disrupted by climate change do not migrate (Adger et al., 2021; Ahsan et al., 2022; Mallick & Schanze, 2020; Steimanis et al., 2021; Suckall et al., 2017). These populations have

received very little attention in the climate migration literature (Cissé et al., 2022; Cundill et al., 2021; McMichael et al., 2021; Pemberton et al., 2021; Schewel, 2020; Zickgraf, 2018). Population immobility in the face of climate risks is often understood as a lack of ability to move, often identified in rural areas, where it is perceived as being stuck or left behind. However, people may stay despite climate risks for personal, socio-cultural, and emotional reasons (Adams, 2016; Farbotko & McMichael, 2019; Mallick & Schanze, 2020; Parsons, 2018; Penning-Rowsell et al., 2013). Immobile populations are rendered invisible in data collection and research design on climate change and human (im)mobility (Borderon et al., 2021, p. 6). As a result, immobility is less understood, anticipated, and planned for in regions where people remain despite the fact that climate impacts are increasingly disrupting rural agricultural livelihoods.

The research questions of this paper are: who stays, why do they stay, what are the consequences of migration for those who stay, and what are their needs for adaptation? We focus on those who stay in the highly mobile agro-Himalayan communities of Uttarakhand in India, where high outmigration has led to abandoned, so-called ‘ghost villages’, and climate change impacts are adding to existing migration pressures.

2. Climate change and human immobility

Immobile populations in the context of climate change were first academically discussed in the Foresight Report which identified four kinds of mobility outcomes: migration, displacement, immobility, and trapped populations (Foresight, 2011, pp. 107–108). With an emphasis on choice, the report looked into immobility from a human agency lens. Furthermore, it stressed that the issue of immobile populations represents a policy concern just as significant as migration (Foresight, 2011, p. 191).

Immobility can be voluntary, involuntary, and acquiescent. The earliest discussions on immobility started in mobility studies and focused on involuntary immobility – those who aspire to migrate but do not have the ability (Carling, 2002). This was later applied to the climate change context, where the involuntary immobile are referred to as ‘trapped populations’ – people unable to move from climate-risk areas (Black & Collyer, 2014). Following that, studies have examined varied reasons for involuntary immobility in the context of climate change, for instance – lack of resources to migrate (Nawrotzki & DeWaard, 2018), psychosocial factors that trap people (Ayeb-Karlsson et al., 2020), and gender roles that limit migration for women (Ayeb-Karlsson, 2020b). Conversely, not everyone wants to move and populations may want to stay despite climate risks – the voluntarily immobile. And reasons include, for e.g. high place satisfaction (Ahsan et al., 2022; IOM, 2019, p. 9), attachment to the community, spiritual ties with ancestral lands (Farbotko & McMichael, 2019), desire to maintain place-based identity, values and knowledge (Yates et al., 2021), and ownership of assets, e.g. land (Mallick et al., 2022). Adding to these analytical categories, Schewel (2020) introduced acquiescent immobility – those who don’t aspire to and are also unable to migrate (Schewel, 2020). However, whether voluntary, involuntary, or acquiescent, there is a growing call to engage with immobility to better understand the experiences, motivations, outcomes, needs, and challenges of the immobile (Durand-Delacre et al., 2021; Tripathy Furlong et al., 2022; Zickgraf, 2021).

Immobility experiences are not homogenous in a population. There is a rising scholarship linking gendered vulnerabilities and immobility in climate change-affected populations (Arora-Jonsson, 2011; Ayeb-Karlsson, 2020b, 2020a; Boas et al., 2022; Chindarkar, 2012; Goodrich et al., 2019; Lama et al., 2021; Mata-Codesal, 2017; Rao et al., 2019). Gender roles and responsibilities as well as socio-structural conditions and deep-rooted economic inequalities, together with limited say in household decision making can render women more vulnerable to climate impacts as compared to men (Abbasi et al., 2019; Ferdous & Mallick, 2019; Goodrich et al., 2019; Goodrich et al., 2019; Goodrich & Namchu, 2019; Khandekar et al., 2019; Resurrección et al., 2019; Sugden et al., 2014). For instance, Rao *et al.*, show that environmental stress is a key depressor for women’s agency in climate hotspots across 25 case studies done in Asia and Africa. They found that climate change impacts led to increased outmigration of men, while women stayed in climate-risk areas working in climate-affected sectors, which resulted in more burden for women, affecting their wellbeing,

health, and nutrition (Rao, Mishra, et al., 2019). Empirical evidence from Bangladesh found that socially immobilizing roles limit women’s mobility in the event of a cyclone. Men were expected to go to cyclone shelters while women were expected to stay put as their mobility was considered unsafe and also socially unacceptable (if women leave it brings bad luck) thereby increasing women’s vulnerability to disasters. (Ayeb-Karlsson, 2020b). In the Himalayas, as men migrate women become the household manager. But despite taking more responsibility women don’t have access to and control over financial resources and nor do they have a say in household decisions, crop choices, livestock management, etc. (Bhadwal et al., 2019; Pandey, 2021). These studies stress the need to understand climate change linked gendered immobility as a part of wider social, psychological, and geographical immobility (Ayeb-Karlsson, 2020b).

Immobility has also been discussed in connection to climate change adaptation (Pemberton et al., 2021). Staying in place is closely related to social values like a sense of belonging, kinship, collective coping, place identity, and emotions attached to landscape, all of which have been identified as key enablers for adaptation (Adger et al., 2011; Blondin, 2021; Graham et al., 2013). Immobility can be an adaptation strategy (Farbotko & McMichael, 2019) and a driver for adaptation (Amundsen, 2015; Khanian et al., 2019), but there are only a few studies that reflect upon this in the climate change-migration-adaptation literature.

In climate policy, the issue of immobile populations has been raised in the United Nations Framework Convention on Climate Change (UNFCCC) climate policy process where the Executive Committee of the Warsaw International Mechanism for Loss and Damage associated with Climate Change Impacts recognizes the need for supporting populations who want to stay and remain in place (UNFCCC, 2016, p. 9). Immobility also finds a mention in other global policy frameworks like the Cancun Adaptation Framework (UNFCCC, 2011), the Global Compact on Migration (GCM) (United Nations, 2018, p. 9/36–10/36), and others like the UNFCCC Taskforce on Displacement (IDMC, 2018, p. 30) and the annual reporting done by the International Displacement Monitoring Committee (IDMC, 2021, p. 85). In the context of policy implications, scholars have discussed immobility as a ‘right to remain’ despite climate risks (Black et al., 2013, p. S39) and as a matter of ‘climate justice’ (Farbotko & McMichael, 2019, p. 158). Emphasizing where policy can focus, the GCM notes, ‘[e]fforts must be strengthened to address the implications of climate change for migration and to foster people’s resilience to remain in place with dignity’ (United Nations, 2021, p. 6/22).

3. Study area

This study is based on data collected from Uttarakhand, India. Uttarakhand lies in the Indian Himalayan Region (Figure 1). The state is divided into two geographical zones: 10 hill districts in the Himalayas (elevation from 300 to 7800 m) which are mostly rural, and three plains districts (<300 m elevation) which include large urban centres.

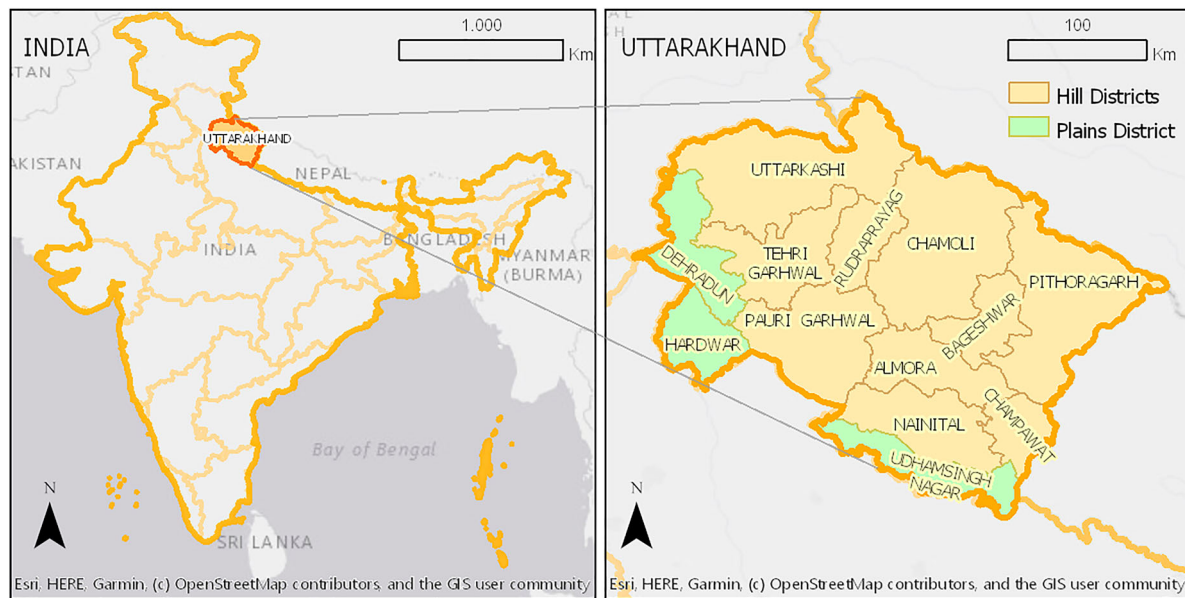


Figure 1. Map of India, highlighting the state of Uttarakhand; on the right the thirteen districts of Uttarakhand. Source: Upadhyay et al., 2021.

The population is 10.11 million (Census, 2011a) with 69.45% rural and 30.5% urban population (DoRD, GoI, 2011). Uttarakhand recorded a negative population growth in 2011 (the last held population census in India) and two districts – Almora and Pauri Garhwal had an absolute decline of 17,868 persons between 2001 and 2011 (Census, 2011b) which resulted in a negative decadal population growth rate for Almora (−1.73%) and Pauri Garhwal (−1.51%) in 2011 (RDMC, 2018, p. 16) (for details, see supplementary material S4). Of the state's total 16,793 villages, 1048 are uninhabited and about 80% of the villages have a population of less than 500 people (Chauhan et al., 2020; RDMC, 2018). Depopulation has led to a complete un-inhabitation in some villages –popularly called ghost villages (Dey, 2017; ICI-MOD, 2017; 'Why the Himalayas have so many ghost villages', 2022).

Migration in Uttarakhand is a livelihood strategy to diversify incomes, adapt to the constraints of rain-fed subsistence-based agriculture, and meet personal aspirations (Gautam & Andersen, 2016; Mamgain & Reddy, 2016; Pathak et al., 2017; Tiwari & Joshi, 2015). The main reasons for migration are lack of gainful employment opportunities, lack of medical and educational facilities, decline in agricultural productivity, structural factors e.g. lack of road access, electricity, irrigation, regional development, and economic inequalities between the hills and plains that influence mobility decisions in Uttarakhand (Bhagat, 2018; Mamgain & Reddy, 2016; NMSHE, 2018; RDMC, 2018; Sati, 2016, 2021). Development gains from economic growth are limited to the 3 plains districts as compared to the 10 hill districts where employment options remain low and dependency on agriculture is high. These factors have been shown to influence migration from hills to plains (GU, 2018a; Sati, 2021). Hills are the migrant-sending regions while the plains which have a higher employment potential due to industrial and service sectors, attract the highest percentage of migrants (RDMC, 2018). Approximately 70%

of migration is internal. The largest group of migrants (42%) are between 26 and 35 years old (RDMC, 2018). Remittances are widely practised –75.5% of migrants remit on an average ~ 1000 USD/year – that are primarily used for buying food, clothing, and organizing everyday life (GU, 2018a). Over the years outmigration has resulted in the depopulation of the mountain villages (GU, 2018a; Mamgain & Reddy, 2016; Pathak et al., 2017; RDMC, 2018).

Uttarakhand is predominantly an agrarian state with 70% of its population dependent on agriculture which is largely for subsistence (GU, 2017b; Naudiyal et al., 2019; Tiwari, 2000). However, agriculture in the hilly areas is subject to severe constraints. Only 14% of the land is available for agriculture with very small land holdings (75% of land holding are less than 1 ha); with low agricultural inputs; 55% of agriculture (by area) is rain-fed; soil is of low to medium fertility and not very productive (GU, 2017b, 2018b, 2018a; Naudiyal et al., 2019).

On top of these constraints, the region is highly exposed to climate change impacts. According to a report by Indian Council of Agricultural Research on future risk and vulnerability assessment of Indian agriculture (for 2020–49, relative to a baseline of 1975–2005), Uttarakhand falls under 'very high risk' due to climate change (Rao, Raju, et al., 2019). For the same time period, the report projects an increase in incidence of extreme rainfall events with more than 100 mm of rainfall in three consecutive days. Ten out of thirteen districts of Uttarakhand are projected to have an increased incidence of drought proneness.¹ Hot days are projected to increase between March–May, where temperature exceeds the normal by at least 4°C during 2020–49 (Rao, Raju, et al., 2019). Another study looking at observational rainfall data found that between 1900 and 2010 the number of annual rainy days declined from an average of 72 days to just over 58 days (Tiwari & Joshi, 2012). Consequently, the amount of annual rainfall has decreased from an average of 132 cm to

approximately 102 cm between 1990 and 2010 (Tiwari & Joshi, 2012). Observed temperatures in Uttarakhand indicate a warming trend where the mean annual temperature has increased by 0.84°C in 41 years (1969–2009) with a more notable increase of 1.41°C during the winter months (Dec–Feb) (Das et al., 2018; Das & Meher, 2019). Projections indicate that the mean annual temperature could increase by 0.5–1°C (2011–2040), 1–3°C (2014–2070) and, 4–5°C (2041–2098) (Kulkarni et al., 2013). These impacts have consequences for agriculture such as – decline in traditional crop yields, decline in apple productivity, loss of native plant agro-biodiversity due to changes in temperature and heavy frosting, increased land degradation and poor soil health due to heavy precipitation events (GoI, 2019; GU, 2014; Isaac & Isaac, 2017; Kaul & Thornton, 2014; Kc et al., 2022; Macchi et al., 2015; Negi et al., 2012; Shukla et al., 2021). Climate change is therefore putting additional stress on an already fragile mountain agriculture sector.

Historically communities have employed migration to adapt to the constraints of mountain agriculture and to diversify their livelihood. However, unreliable agricultural outcomes due to climate change are shown to increase outmigration in the region (Arlikatti et al., 2018; Banerjee et al., 2014; Bhadwal et al., 2019; Joshi, 2018; Sati, 2016; Tiwari & Joshi, 2015; Maharjan et al., 2020; Naudiyal et al., 2019; Resurrección et al., 2019; Siddiqui et al., 2019; Upadhyay et al., 2021). The Uttarakhand Action Plan on Climate Change (GU, 2014) also notes this linkage ‘[c]limate change-driven fluctuations in the precipitation pattern have increased uncertainty in the farm output’ whereby ‘[l]abour-intensive hill farming has been rendered unsustainable and the region is presently threatened by food insecurity’ (p.105) which has ‘[f]orced people to migrate from the hills’ (p. 105).

4. Methodology

Qualitative, semi-structured, face-to-face interviews ($n = 72$) were conducted between September and November 2019, mostly in Uttarakhand and two in New Delhi (see full details in S1). Interviews were done in 13 villages across four districts of Uttarakhand – Almora, Pauri Garhwal, Dehradun, and Nainital (Table 1). The village selection was done in consultations with key informants and regional experts. In addition, data and information on climate change impacts and migration in the state were assessed before the sites were selected (Banerjee et al., 2020; GU, 2018b; Guhathakurta et al., 2020; INRM, 2016; Jain, 2010; Mamgain & Reddy, 2016; Mishra, 2017; Negi et al., 2021; Pathak et al., 2017; Paudel et al., 2021; Rao, Raju, et al., 2019; RDMC, 2018; Tiwari & Joshi, 2012, 2014, 2015, 2016; Upadhyay et al., 2021). All the selected villages were affected by gradual depopulation, as per the information shared by the villagers; however, this could not be verified with public data, as such data is not available at the village level. Several villages in the selected districts had undergone complete depopulation and become uninhabited (see Table 1). The selected villages had a varied population size with high agricultural dependency (Table 1), except the state capital of Dehradun where agricultural dependency was lower as compared to the rest of the interview sites. Depopulated

communities have been selected as they face the twin impacts of high out migration and increasing livelihood risks due to climate change.

To assess immobility in climate change-affected communities, we analyzed the experiences, reasons, and impacts of immobility from two perspectives. One, staying communities – who shared their lived experiences from an individual perspective. Second, key informants – who provided a community perspective. They had specific knowledge that was relevant to the study such as local experts on climate change, agriculture, and migration; civil society actors working with the affected populations; policymakers who were working on implementing policies related to climate change adaptation, migration, and development. They were interviewed to receive practical insider knowledge and background information which helped in interpretation of results (Bogner et al., 2009; Döringer, 2021).

Of the 72 total interviews, 54 were conducted with the affected population, while 18 were done with key informants. Snowball sampling was used for recruiting affected people while purposeful sampling was used for selecting key informants (Bhattacharjee, 2012; Creswell & Plano Clark, 2018; Patton, 2005; Rubin & Rubin, 2005). Snowball sampling is particularly useful when the participants are not easy to access, for e.g., in our study, it was challenging to find interview partners due to the mountain remoteness and depopulation in villages. Therefore access to the networks of initial participants was crucial for identifying additional participants.

An interview guide for key informants and the affected population was used. Interviewing combined structured questions with some unstructured exploration (Wilson, 2014). When necessary spontaneous probing questions were asked for clarifications and to make sure that the experiences and understandings were fully captured. Data saturation (Guest et al., 2020) was reached when no additional data was found and the same themes got repeated (Glaser & Strauss, 1967; Small, 2009). Our analysis is based on the grounded theory that does not seek to be representative but rather explanatory following an inductive approach that is grounded in data (Glaser & Strauss, 1967).

Interviews focussed on one key interviewee from a household. Interviews were conducted in Hindi, which was understood by all the interviewees, however, at times people would reply in Kumaoni or Garhwali (regional languages spoken in Uttarakhand) which was understood by the lead author of the study. Some interviews with the experts were conducted in English. Interviews lasted between 20 and 90 min each and were either audio recorded or text notes were taken. Interviewees gave informed consent and their data was anonymized and kept confidential. Qualitative data collected from the semi-structured interviews were translated and transcribed in English and later analyzed in MAXQDA to arrive at different categories (codes) which are presented in the results section (see section S2 of supplementary material for details on using MAXQDA).

The findings of this study should be seen in light of some limitations which could be addressed in future research. Information on social hierarchies (e.g. caste), household income, assets, and relative power positions within the community – adds to the understanding of immobility. In our study, during field research, the authors were advised to avoid culturally

Table 1. Interview sites.

Name of the district	Name of the village/city: Interview site	Total population (2011)	Percentage of district population engaged in agriculture (2011)	District wise total number of inhabited an uninhabited villages
Almora	Dhaspar	204	67.71%	Inhabited villages: 2146 Uninhabited villages: 96
	Toli	7		
	Hawalbagh	71		
Pauri Garhwal	Khola	210	48.29%	Inhabited villages: 3114 Uninhabited villages: 341
	Sumari	409		
	Jaletha	244		
	Bhaskot	293		
Nainital	Satauli	290	40.76%	Inhabited villages:1052 Uninhabited villages:16
	Kaphura	478		
	Kumati	168		
	Virkhan	87		
	Nigrar	83		
	Kotla	815		
Dehardun	State capital (city)	1.6 million	16.55%	Not applicable

Source: (Census, 2011c; GU, 2017a, 2019, 2020b, 2020a).

sensitive questions on caste-based identification as they can be discriminatory. The authors did carefully attempt to ask questions on income, however, interview partners were not comfortable giving such answers fearing negative repercussions. For this reason, also the question to which extent remittances play a role as reason to stay could not be investigated. Future work may well go deeper into these aspects, given that culturally acceptable ways can be found to address these issues in interviews. Furthermore, future research may strive to improve our efforts by examining intra-household and inter-sectional vulnerabilities.

5. Results

Following is a list of the topics that arose from the analysis of the interviews and are used to structure the results. 1. Who stays? 2. Social system of the study population. 3. Climate change impacts reported by the people. 4. Reasons for staying (the naming of the themes presented in this section captures the general meaning shared by many different specific answers). 5. The impact of outmigration on the immobile. 6. Adaptation needs of those who remain in place.

5.1. Who stays?

Of the 54 interviews done with the affected population, 51 were doing agriculture (of which 32 were doing only subsistence agriculture while 19 had some occupation in addition to agriculture), 2 received pension but still did some agriculture while only 1 interviewee did not practise agriculture.

From a gender perspective, 29 men and 25 women were interviewed. Concerning livelihoods, of the 29 men, 10 worked in subsistence agriculture while 18 had another occupation in addition to agriculture and 1 was running a shop and was not engaged in agriculture. For women, 22 were working in subsistence agriculture, while 2 received a pension and 1 had an occupation in addition to agriculture (Table 2).

As for age, it was mostly the middle-aged and elderly people who were staying in the village while the young people had out-migrated (Table 3). As interviewee A6 said: 'Earlier everyone from the village was also living in the village, our children were here at home. Now you can no longer find young people in the village'.

In several villages like Kumati, Kaphura, and Khola it was common that elderly widows lived alone in unstable houses that were in need of repair. Sixteen interviewees had lost their spouse, of which 15 were 60+ years of age who lived alone. Interviewee PG 7 said, 'It's mostly old women who live alone in these houses. Until they are alive the houses are alive. When they will pass the houses will fall too'.

5.2. Social system

The study population shares certain characteristics regarding their social system that can be inferred from the interview data (Tables 1 and 2) and field observations. The majority of the interviewees were subsistence farmers (see section S1 of supplementary material) with many generations farming on the same land. Most agricultural work was done using family labour. Women performed most of the agricultural work and tended to the animals. They were also responsible for collecting water, firewood, and fodder and preferred to do these activities as a group. Cultural traditions and community-based institutions protected the forests which were integral to agriculture and animal husbandry. The annual collective gathering of villagers to honour the local deity and conduct sacred ceremonies was of social importance, even to the migrants who came to attend. Knowledge about the environment and livelihood resources was accumulated over generations and passed down to the family unit. While adapting to weather conditions is at the core of the farming experience, increased variability due to climate change was described as unprecedented and presenting new challenges. Most of the farmers were illiterate which made them rely on social networks to seek information on pest control, new farming techniques, crop choices, farm inputs, weather advisories, etc. Agricultural losses were either managed at the household level or mediated by the community, with limited intervention by the government and other formal institutions. It was reported that there are virtually no government insurance schemes in the region.

5.3. Reported climate change impacts, coping, and links to migration

Interviewees reported climate change impacts such as increased temperature, erratic rainfall, and reduced snowfall.

Table 2. Gender and livelihoods of the interviewees.

Gender/ Livelihood	Subsistence agriculture	Additional occupation +Agriculture	Pension	Job	Total
Men	10	18		1	29
Women	22	1	2		25

Table 3. Age of interviewees.

Age group(years)	Number of interviewees
Young adult (18–30)	3
Middle aged (30–59)	34
Elderly (60+)	17

A1 said, 'It is hotter as compared to before. Back in the 80s when I was studying, there was no fan or refrigerator. Now every home has both'. While this could also indicate economic development, the interviewee stressed the necessity of having these amenities because of rising temperatures and heat extremes. Changes in crop yields were also reported, as A6 recounts, 'It doesn't rain on time so nothing is growing. Earlier I produced 8 sacks of finger millet, now I can manage only 1 sack. I grew 40 sacks of potatoes before now there is hardly anything'. While the respondent did not have scientific knowledge of the changes in the environment, they closely observed how these affected their livelihoods. They also connected the impacts on household food security,

Right when the harvest is ready for us to eat, the weather betrays us. After harvesting the finger millet I had kept it for drying but then it rained when it should not have and now it is spoilt. What do we eat now? We are fed up of doing hard work and in the end, be left with nothing. (A6)

This quote indicates a general frustration that could be sensed in many interviews about the unpredictability of changing weather patterns and the challenges to anticipate and adapt to it.

Interviewees were asked how they coped with crop losses. The answers ranged from bearing the loss to buying food and

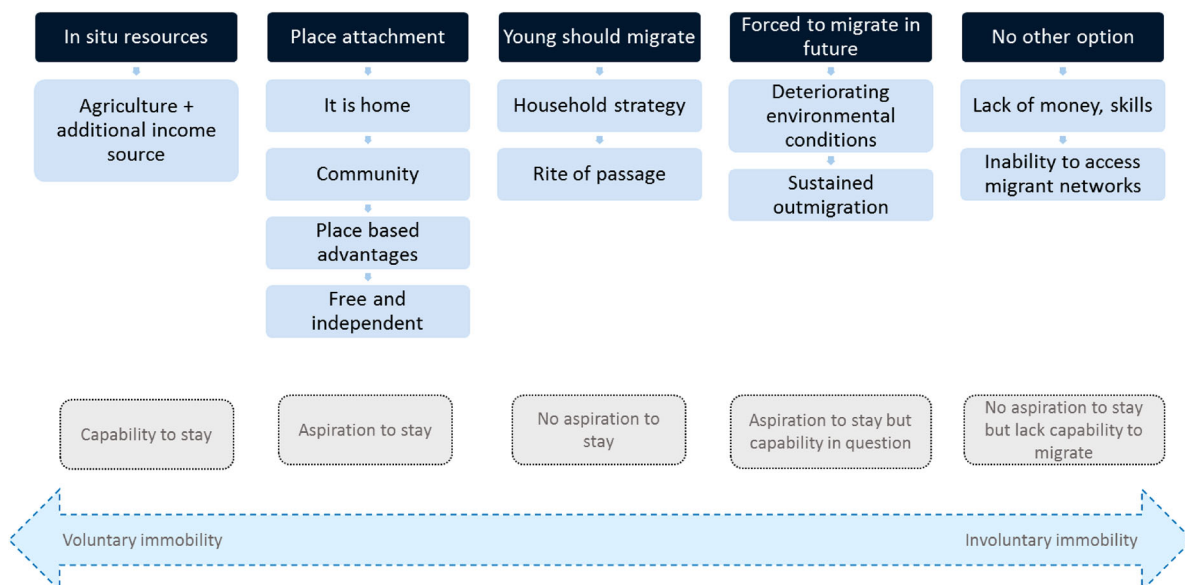
undertaking migration. Interviewees said they endured the loss as they did not have the capacity to mitigate the losses (PG8, PG9, PG16, A4, A19, N4, N5, N6, N7 and N11). Interviewee PG8 said 'What can I do? Nothing. If it gets destroyed then that's how it is', When probed further on how did they manage household food security, some said (A14, A16, and N2) they bought food from the Government's public distribution scheme (PDS) which offers food grains below-market prices (for PDS, see Chakraborty, 2000; George & McKay, 2019; NFSP, 2021). Interviewees were also asked if they used crop insurance to alleviate the loss, only three were using it (A3, A4, and A11) while others said that they did not have crop insurance due to lack of information and lack of affordability (A5, A14, A16, N2, N3, N7, N11, N12, PG8, PG10, PG14, PG15, PG16).

Reflecting on the coping options, A16 said 'first we would buy food. Second we do wage labour, here in the village, if we don't find anything here then we migrate outside'. This indicates that this household attempts to adapt in place through various measures, before deciding to migrate as the option of last resort. Three interviewees (A7, A14, and A16) specifically mentioned temporary migration as means of coping with crop failure. This interpretation is further supported by remarks from nine additional interviewees (A3, A6, A7, A14, N6, N11, PG11, PG14, PG16) who noted how migration might increase as climate change adds to the existing migration pressures

Migration will increase as nothing is growing in our fields. We do seasonal farming and it is not raining as much as we need, so we are suffering. Farming is dead. And there are no jobs or livelihood alternatives. What will people do then? They have to migrate. (N11)

5.4. Reasons – why do people stay?

Although each interviewee provided an individual, and distinct response to the question 'why are you staying?', to synthesize the replies on a more generic level we allocated them to five categories (Figure 2). The allocation procedure is documented in the annex. Of the 54 interviews done with the

**Figure 2.** Reasons that interviewees gave for staying.

affected population, often people gave more than one distinct response, of which we attributed 29 to the category place attachment, 16 to in situ resources, 15 to the young should migrate, 5 to no other option, and another 5 to anticipated forced migration in the future. In the allocation and interpretation process, we also used contextual information on socio-economic and cultural structures from the expert interviews ($n = 18$).

In situ resources

In situ resources is an encapsulating term for the 16 interviewees who mentioned *additional income* from occupation outside agriculture as a reason for staying (see section S3 of supplementary material). The occupations mentioned included tailoring, working in transport, running a tea stall, water pump operator, etc., and some had trans-local livelihoods (full details in S1 and S3). Apparently, these additional livelihoods provide a capacity to cope with agricultural losses as compared to those who were completely dependent on subsistence agriculture. It thus reflects lower exposure to climate impacts. Importantly, all 16 interviewees who had in situ resources were male. In the studied communities, men clearly have better options to earn a living outside agriculture, which makes them less vulnerable to climate change impacts than women, who almost exclusively rely on agriculture.

Place attachment

With the term place attachment, we refer to various bonds between an individual and places (Altman & Low, 1992; Scanell & Gifford, 2010). Twenty-nine interviewees mentioned different versions and expressions of place attachment. The most important manifestations were the following:

It is home. Staying was rooted in the preference for ‘home’. It refers to emotional bonds that people develop to a particular physical environment. In our interviews, people expressed this in the following ways. Interviewee A6 said, ‘I like living in the mountains. I have lived here all my life and I will die here too. This is my home. I don’t like living anywhere else’. Such remarks exemplify the convictions shared by many interviewees who had a clear preference for continuing to live in the village. The strong intention to remain until death underlines the importance that is ascribed to staying. It also shows that the *length of residence* – ‘I have lived here all my life’ – is connected to the preference for staying. Interviewees cited specific skills, knowledge, relationships, networks in their village that bring them opportunities, livelihood, respect, etc., and all this would be lost if they migrated. However, for some immobility was not only preferred but also desired, even when opportunities for migration exist. As PG4 remarks ‘my children migrated to the city and asked me to join them but I have lived in the village my entire life and this is my home. Here I find comfort and I like also living here’. The quote affirms the *preference for the village vis-à-vis migration*. It shows that there are active stayers who assess their situation realistically and make a decision to stay. The remarks on ‘comfort’ and ‘like living here’ also indicate how staying in place is linked to individual wellbeing. Home was also connected to the

village specificities like the temples, as explained by interviewee N12, a return migrant,

[i]n our village we have 3 temples and I am attached to them. I am staying because of the temples. I believe in their energy and once I migrate I feel I won’t be able to visit the temples. I light lamps in these temples. It brings me joy.

This highlights how immobility is rooted in personal beliefs and shaped by local factors. The ability to access cultural and religious sights is a strong motive for staying.

Place-based advantages. Place-based advantages refer to *location specific attributes* like better air and water quality of the mountains, organic food from mountain agriculture, and availability of more living space in the village as compared to the cities. These can be understood as ‘retain factors’ which shape home as a better place to be than elsewhere. Interviewees emphasized their preference for the mountain environment, as N7 stressed,

[w]e have a pure environment in the mountains, with good air quality and clean water. People from here migrate to Delhi, where the air is so polluted that you have to wear face masks. There are mosquitoes; there is a lot of heat and noise. What kind of a life is that? Around 15 years ago, I lived in Delhi for 3 years, and it was horrible. In the village, we have lots of open space and in Delhi, I was in a small room, for fresh air there was a tiny balcony. I felt quite claustrophobic like someone had locked me up.

This quote shows how villagers weigh the place-based benefits of staying. They reflect upon the natural resource advantages in the village as compared to the problems of pollution in urban areas. In doing so, it highlights an attitude of sufficiency, of being content and being able to live with what is available, rather than pointing out the disadvantages of village life.

Community. Another reason for staying in place is community. Staying in a community meant that a societal code of conduct was practiced which, in the case of Uttarakhand, means that a *social stratification* of the caste system was maintained (see Vallabhaneni, 2015). Interviewees identified themselves along a social hierarchy and expected others to reciprocate accordingly. When people identify with a certain caste it shapes the rules of social conduct, the dos and don’ts, shared traditions, and values which are a part of everyday life and shape who is their community. Living in the village, where such distinctions are tightly held and practiced gave the interviewees a sense of community. PG10 who had migrated earlier and then returned explained the experience

[h]ere in the village, I have my community, people who are like me, who share the same values. In the city, nobody respects societal hierarchies. To whom will I talk to in the city? Where will I find my community?.

The quote reflects a sense of alienation in migrant destinations and a possible social disintegration. Shared values and traditions provide a structure that is essential to many people who chose to stay. It also shows a sense of loss of community after migration.

Community is also a means of *collective action* or a way of helping each other where people would self-organize, as N12 said

[i]n our village people help each other. In times of need, we are there for each other. There is cohesion and people come together by themselves. It's a matter of me calling out to them and the villagers will assemble.

In the absence of formalized social security programmes, the community is essential to assist during times of hardship. Beyond the economic dimension, a support network also contributes to personal wellbeing. It also helps people draw on collective knowledge which is rooted in the place, emanates from the community, is communicated informally, and is collectively owned.

Free and independent. Free and independent refer to aspects of personal well-being highlighted by the interviewees. For some interviewees staying in the village offered them the *freedom of expression to live a self-desired life*. PG5 said

I have seen how people live in the cities, in those matchboxes of houses. By mistake, if the water from your clothes drips off to the people who live downstairs, they may insult you. There are many do's and don'ts. Here in the village we are free, we are independent. We don't have to worry about such things. (PG5)

Interviewees were concerned that if they migrated to a city, they will be referred to as *gaon wala* (Hindi for people who come from village) – implying those who are uneducated, uncivilized or unsophisticated. They were concerned that their village ways of life, rituals, language, customs, even ways of eating and living would be looked down upon. Therefore living in the village, offered them the freedom to live a self-desired life, as noted by PG4 'We can express ourselves freely here, there is no mental stress. I have peace of mind. I don't have to worry what people will think'.

The elderly were concerned that if they moved to be with their migrant children they would become dependent on them. While in the village they were *independent and self-sufficient*. N8, a widow in her 80s, has been asked many times by her children to join them in the city but she prefers to live in the village as

I don't want to be a burden. Here I can do things the way I prefer. If I migrate to join my children I will have to follow their ways. I am getting older but I have what I need, I can manage my food and whereabouts in the village. I am independent. If I migrate I will become dependent on my children.

Young should migrate

In our analysis, 15 respondents placed the expectation of migration on the young while the elderly preferred to stay in the village. This could be a *household livelihood strategy* as the young have better chances to find wage labour, acquire new skills, and access education opportunities as compared to the elderly who were illiterate and perhaps won't receive similar opportunities. As PG 16 sum sup:

We have around 10–12 young boys left in our village. In a few years, when their studies are over, their families will tell them to

go find a job in Delhi. So they have to migrate. Parents want their children to migrate and earn money. (PG 10)

This indicates three things first the expectation to migrate is placed on – young males – which is consistent with studies across the globe (Aslany et al., 2021). Second, those who are educated are expected to migrate as even with better education, respondents did not think that the younger generation would have access to alternative forms of employment in the rural areas, nor experience upward social mobility. After receiving an education, working in agriculture was not desired. Finding a job and earning money in the cities was considered as 'made something of yourself', a *rite of passage*, and represented a sense of success and led to upward social mobility. As PG17 notes 'I have a job and I make 28000 INR (~340 USD) per month in the plains, if I stay here I will not have a job and no income'. Third, it also underlines the remittance economy of Uttarakhand (Jain, 2010). The ability of the elderly to stay has a functional interdependence with young who migrate – via remittances. Survey studies done in the region show that 75.5% of migrants remit money – most often every month (GU, 2018a). Additionally, the instability of subsistence-based agriculture and lack of any alternate income-generating options in the village further reproduce such expectations.

Forced to migrate in the future

Five interviewees (N6, N11, N12, PG16, and PG17) wanted to continue staying in the village but were also suffering from *deteriorating environmental conditions* such as the drying of mountain springs – the primary source of drinking water. While trying their best to cope, interviewees anticipated that in the future if water stress got worse they would have no option but to migrate. N7 shared

our mountain springs are dry, and we don't have water to drink. I wanted to take my medicine but there was no drinking water in the house. I had to wait for my grandchildren to return from school, then they ran to the village common pool water area to fetch some drinking water.[...] If it doesn't rain, then we face water problems. If there is water, there is life, and without water there is nothing. I wonder how long we can live here, if it continues like this we too will be forced to migrate.

While some were concerned about *sustained outmigration* and it was a matter of how long can they stay if everyone was out-migrating (N6, PG16).

No other option

Five interviewees (A3, N7, N11, PG1, PG2) wanted to migrate but were staying in the village as they had no other option. This was due to both lack of resources and *lack of skills* to find employment after migration 'I cannot migrate as I don't have the money and I am illiterate. If I migrate I will end up washing utensils in hotels, so compared to that I am better off doing farming in my village' (N7). The majority of the interviewees were subsistence farmers who have farmed the same land for generations. Their primary skill set is farming and without any additional skills, they were apprehensive about their life situation after migration. In addition to lack of skills, some did not have *access to migrant networks* or the

necessary resources to facilitate migration, as explained by an expert working on climate change and migration in the region

[e]veryone cannot migrate. In some villages you will find that many houses are locked and empty while some have collapsed, they are damaged, and nobody is living there as people have migrated. But you will find some people are living in between these collapsed houses. They are the poorest people, they cannot migrate. They don't have options but to stay in the village. They do agriculture, don't have money, don't have any relatives with whom they can migrate, or a son who is working in the city or bigger towns. (N1)

5.5. Impacts of migration on the immobile

Those who stayed in the village reported how the outmigration of other residents affected them. These include *impacts on agriculture*, via shortage of agri-labour as people migrate. As a result, there are fewer people to do agriculture, which in turn leads to more migration. Consequently, older people have to carry the burden of labour-intensive subsistence farming. As an expert D2 puts it,

Villages function as communities and it only works when there are people in the community. If a third of the village is gone, it becomes challenging for the rest to stay. This [is] more true for agriculture where active farm plots are interspersed with inactive and fallow ones. This reduces productivity and over a period of time and becomes a challenge for those doing subsistence-based agriculture.

As young people migrate it has an impact on the *demographic composition and size* of the population. One such impact is the elderly staying alone who experience emotional distress as their family members and fellow villagers out-migrate, as PG12 recaptures,

houses here are just standing for nobody, as everyone is outside. Old people like us, who have nowhere to go, are still here. It is lonely and I feel sad. When my children come, it feels good to see them around.

This indicates the psycho-social impacts and loss of wellbeing experienced by the elderly as a result of the highly mobile environment that they inhabit.

5.6. Needs to adapt in place

Our analysis shows that interviewees had needed to adapt in place which included (i) *need for information* on crop suitability, on what to grow in a changing climate. Respondent N6 said:

If we could get information about what one can grow, either a fruit or a flower which can survive in these changing weather conditions, it would help us. I wanted to grow medicinal plants, I have already tried it twice, but due to lack of water here it hasn't been a success.

(ii) *Need for improved infrastructure*, e.g. water storage structures, and roads '[w]e need infrastructure. The road we have is a dirt road and we need a proper motorable road. It will be a huge comfort to us' (A8). (iii) *Need for alternative employment* options. Except for agriculture, there are few other employment options in the region, 'the main problem is employment. If we have alternate livelihoods here, migration

will stop' (A7). (iv) *Need for farm support*, e.g. accessible agriculture extension services and an adequate selling price for crops: 'we need marketing of agri-products. So that we get the right price for our crops and the government needs to help us with that' (N10).

6. Discussion and conclusions

Four different categories of evidence are presented in this study. First, we provide information on demographic indicators, social system, climate change impacts, and local livelihoods that give a context for understanding the social and environmental constraints under which these communities operate. Second, the self-reported reasons for staying. Third, the impacts of migration on the immobile. Fourth, need for adaptation. We focused on remote mountain populations that are at the frontlines of climate impacts but are often difficult to access, often neglected in data collection exercises, and are potentially less documented than the more accessible populations (Borderon et al., 2021; Nature Climate Change, 2021).

We find that reasons for staying are heterogeneous and fall along a continuum of voluntary and involuntary, and are influenced by aspirations – desire to stay, and capability – means to stay (Carling, 2002; Carling & Schewel, 2018; de Haas, 2021). Figure 2 shows that in our study, the voluntarily immobile are those who stay for place attachment (aspiration to stay) and have in situ resources (capability to stay) (Blondin, 2021; Steimanis et al., 2021; Tebbboth et al., 2019). While at the other end are the involuntarily immobile or trapped populations – those who want to migrate but stay due to lack of options to migrate (lack of capability). In between are those – who want to stay but anticipate forced migration in the future – who have the aspiration to continue staying but not the capability to adapt to increasing water insecurity due to climate change. Such experiences do not fit neatly into either voluntary or involuntary. Instead, they indicate a potential transition in the future from voluntary to involuntary unless early action can support communities to adapt in place. Furthermore, we acknowledge that situating immobility experiences as entirely voluntary or involuntary is challenging as often these boundaries are blurred as motivations to stay are complex, dynamic, and subjective (Erdal & Oeppen, 2018).

For example, we find that the distinction between voluntary and involuntary gets blurred when viewed through a gender lens. Women express their wish to stay, but at the same time face mobility constraints as a result of socio-structural conditions, cultural norms, and patriarchal power structures. Which raises the question that to what extent can women's immobility be considered voluntary? Do they really have a choice? We conclude that staying is the only realistic option available for women as socially immobilizing roles are applied to them which inhibit their mobility. This has also been noted by other studies (Bhadwal et al., 2019; Goodrich, Prakash and Udas, 2019; Resurrección et al., 2019).

Regardless of whether people stay voluntarily or involuntarily, both groups are vulnerable to climate change risks with limited capacity to adapt. Agrarian communities in Uttarakhand were seeking external support in terms of resources,

information, and opportunities that could help them adapt. Therefore attention needs to be paid to groups whose vulnerability will potentially increase when they remain in place – especially women and the elderly. Policies need to address both the need to adapt *in situ* (e.g. by developing alternate livelihood options) and also facilitate the option of adaptation through migration for the involuntarily immobile populations (e.g. by skills development, strengthening the education of women and girls). In addition, such policies need to be gender-sensitive, taking into account the specific vulnerability of women and social constraints on their ability to reduce vulnerability.

Also, immobility experiences are heterogeneous and largely dependent on three factors (i) Age or life-course stages – older people want to stay (are well settled, have a preference for community, and show a resistance to migration, as they perceived or expect negative social and environmental conditions in the destinations that are accessible to them) while younger people do not wish to stay in the village and were in fact waiting for a migration opportunity (aspirations for a better life). (ii) Gender – men migrate while women should stay and take care of household, fields, elderly and children; and (iii) *In situ* resources – those with additional occupations in non-climate sensitive sectors are likely to be less affected by climate change impacts as compared to those who depend solely on a climate-sensitive sector like rain-fed agriculture which is for subsistence. The majority of the former, are women who have limited resources to adapt, thereby making them more vulnerable.

Especially the gender-prescribed roles of men as breadwinners and women as homemakers – facilitates male mobility and restricts female mobility. In rural Uttarakhand women are food producers working in subsistence agriculture. They are also responsible for household chores, collecting fuelwood and fodder, fetching drinking water, and taking care of the children, elderly, and animals. Despite taking on many responsibilities women have limited ownership of household assets (e.g. land) and little say in the household decision-making process (Tiwari & Joshi, 2016). In times of disasters, women are denied compensation for the land they cultivate as men are recognized as household heads, and compensation is paid to them (Asthana, 2012, p. 102). In our analysis, 88% of women were engaged in subsistence-based agriculture as compared to 34% of men. This shows that as compared to men, women almost exclusively rely on agriculture – which has become increasingly unreliable due to the impacts of climate change. In addition, 62% of men had an additional occupation that they could fall back on if there were losses in agriculture as compared to only 4% of women – which has implications for the adaptive capacity of men and of women. Insights here suggest, that high dependence on climate-sensitive sectors along with gender inequalities render women more vulnerable to climate change, which also confirms the findings from other studies (Ayeb-Karlsson, 2020b; Boas et al., 2022; Goodrich, Prakash and Udas, 2019; Lama et al., 2021; Pandey, 2021; Rao, Mishra, et al., 2019; Resurrección et al., 2019; Tiwari & Joshi, 2016).

In addition to gender roles, there are different age-related expectations about mobility and immobility. The elderly

focussed on taking care of agriculture, livestock, and maintaining assets like land, while the young were expected to earn in cities and send back remittances. Therefore functionally, the immobility of the elderly is tied up with the mobility of the young. As Tripathy Furlong and colleagues note ‘immobility simply does not mean left behind but an agency-led action that seeks to give the stayers perspective’ (Tripathy Furlong et al., 2022, p. 12). However, this does not necessarily mean that mobility or immobility is sufficient as an effective adaptation strategy towards climate change (Sakdapolrak et al., 2023; Vinke et al., 2022).

We show that the majority of those who explained their preference to stay with affirmative answers, such as attachment to place, community, and culture were also concerned about deteriorating livelihood resources due to climate change impacts, increased outmigration, declining agricultural labour force, lack of insurance, lack of information, and a general lack of attention by the government. However, a significant number of interviewees mentioned negative experiences and perceptions of the environmental and social conditions in potentially accessible destinations as reasons to stay. Overall, we conclude that expressed voluntary immobility does not imply less vulnerability. In fact, we show that staying populations in Uttarakhand are highly vulnerable to climate risks, have little attractive alternatives and need external support to adapt in place. And, it is for the government, public institutions, aid organisations to engage with the needs and priorities of such populations.

Our analysis broadens the discussion on immobility beyond economic factors which are often the focus (Biswas & Mallick, 2021; Farbotko et al., 2020; Gray & Mueller, 2012; Mallick, 2019). While the relevance of factors other than lack of resources, such as, social, cultural, demographic, and environmental factors influencing climate change-related immobility has been noted (Black et al., 2011; Foresight, 2011), our study adds much more specificity, e.g. how place attachment, community and gender (social and cultural), age (demographic), advantages of mountain environment as well as stressed mountain resources (environmental), as well as lack of and sufficient *in situ* resources (economic) shape immobility. We thus demonstrate that a localized lens on people’s perspectives and experiences is crucial to understanding immobility.

By studying remote mountain communities who are under-represented in climate change research and focussing on immobility, an under-researched topic in climate migration, our study provides empirical evidence on the differentiated experiences, outcomes, and needs of the immobile populations in climate change-affected regions. Most importantly, our study demonstrates the need to focus on gender differences in affectedness and capability to cope with climate change impacts, by including women’s concerns into the core of the research design, as also substantiated by a recent literature review (Dev & Manalo, 2023)

Climate change and immobility require further attention in research and policy on climate adaptation. Although the details will be different, the general insights from this study likely apply to other rural, smallholder communities, where some women and elderly stay despite increasing migration

pressures from climate change. Similarities are already apparent to communities in other mountain regions (Adams, 2016; Bhusal et al., 2021), semi-arid regions (Rao, Mishra, et al., 2019), Pacific Islands (McMichael et al., 2021), and indigenous peoples (Suliman et al., 2019).

Note

1. Index computed by combining the probability of occurrence of severe and moderate droughts with respective weights of 2:1 and expressed as %. Incidence of more frequent droughts implies more risk in agriculture (Page 10 of the report)

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