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Mapping the Climatic Hazards and Internal Displacement in India between 2011-2021

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Abstract: The frequent climatic hazards are the foremost factor for internal displacement in India, which is ranked first among the south Asian countries. This article intends to examine the temporal change and spatial distribution of internally displaced people due to different natural disasters in India using a globally representative data set of the Internal Displacement Monitoring Centre (IDMC). The eastern and south-eastern region is worst affected due to frequent natural hazards and displaced millions of populations. More specifically, we argue that flood is a leading cause of internal displacement in India. Furthermore, the spatial pattern of the reason behind displacement significantly varied with space in India. The seasonal variability of monsoon wind-related atmospheric disturbances increases the frequency of cyclones in the eastern and south-eastern regions and is positively associated with huge displacement in India.

Keywords: Displacement, Hazard, Disaster, Climate Change, India

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Introduction

In the field of migration, research on the interconnections between internal displacement, mobility, and migration is widely known (Adger *et al.*, 2018: 29-41). Internal displacement continues to be one of the world's most pressing humanitarian problems. Internally displaced persons (IDPs) are individuals or groups who have been compelled to evacuate or leave their homes or places of habitual abode due to both spontaneous and induced catastrophes within the state boundary (Mallick, B., and Vogt, J., 2014: 191-212). Every year, millions of individuals experience internal displacement, escalating as a transition of climate change and socio-political turmoil (Wadini, P. 2019: 16-22). Moreover, the spatial pattern of internal displacement is knowingly heterogeneous, and the regions with severe climatic and human-caused disruption are more vulnerable to internal displacement than their stable counterparts (Schmeidl and Hedditch, 2018: 177-199).

Over 59 million individuals—more than 90%—experienced internal displacement as a result of war and violence at the end of 2020 (Kothari, U. 2014: 130-140). South Asia accounts for 16% of global IDP in the year 2021. While conflict and violence are the primary causes of displacement, particularly in African countries, natural disasters are also a significant factor in South Asian countries. Furthermore, out of 5.9 million displaced populations, 88% became displaced due to natural disasters in South Asia (Singh, O., and Kumar, M., 2013: 1815-1834). Regarding the number of internally displaced persons, India ranked first among the South Asian countries. India experiences internal displacement more frequently as a result of weather-related catastrophes than from conflict and violence. Furthermore, natural disasters like landslides and earthquakes in the north and north-east regions, pseudo-monsoons that cause drought in the central part, coastal cyclones caused by air mass disturbances in the Bay of Bengal, and bursts of monsoon that cause floods in the middle-Ganga plain are common and positively linked with internal displacement (Shi *et al.*, 2015: 309-323; Kale, V. S., 2003:65-84). The IDMC figured out that 40 million people were internally displaced due to climatic hazards in India during 2011–2021 (Panda, A., 2020).

Although numerous researchers have examined slow-onset, disaster-induced migration in India (e.g., Devakumar, 2008: 1211-1225; Hussain, 2006: 391-393; Jha, 2013: 133-145; Das *et al.*, 2020; Debnath and Nayak 2020: 1-22), little is known about the temporal changes and spatial patterns of internal displacement in India. To the best of our knowledge, few studies have been carried out at national level, but there are no state level comparative studies on this issue. This study comprehensively analyzes trends and spatial patterns of internally displaced people in India between 2011 and 2021. The study also framed internal displacement in India due to major natural catastrophes. This research will assist in formulating the policies and plans for emergency support for internal displacement based on space and episode.

Data Sources and Methodology

The present study used the most authoritative source of worldwide data on displacement from the Internal Displacement Monitoring Centre's (IDMC, www.internal displacement.org/) Global Internal Displacement Database, which collects daily information on the occurrence of displacement, estimates of new displacement during the year, and the total number of people displaced at year's end. It also provides information on disaster-induced displacement on an event-by-event basis. They collect information from different sources for each event and generate the most comprehensive and reliable displacement estimate for that disaster. They rely on comprehensive data

sources, including national and subnational government authorities, UN agencies and other international organizations, global databases, civil society organizations, news media outlets, and other entities.

Analytical Approach

The analytical approach contains bivariate and descriptive tabulations to examine the level, trends, and displacement pattern. The internal displacement's stock and climatic hazards have been arranged in different years to comprehensively understand the displaced people's scenario in India and the state. The major tropical cyclone events and the number of displaced people were identified to address the question of which tropical cyclone displaced more people in India in recent years. A state-level analysis was performed to understand the spatial pattern of India's internally displaced migration. Suitable cartograms, charts, and graphs were used to represent the displacement scenario in India.

Results

In recent years, the number of internal displacements due to natural disasters has increased in India. Around 40.03 million Indians were internally displaced due to natural disasters between 2011-2021 (Figure-2). Out of the total internal displacement parsons, 72% were displaced due to floods, followed by 27% by storms and other natural events (0.6%) during 2011-2021 in India (Figure 1).

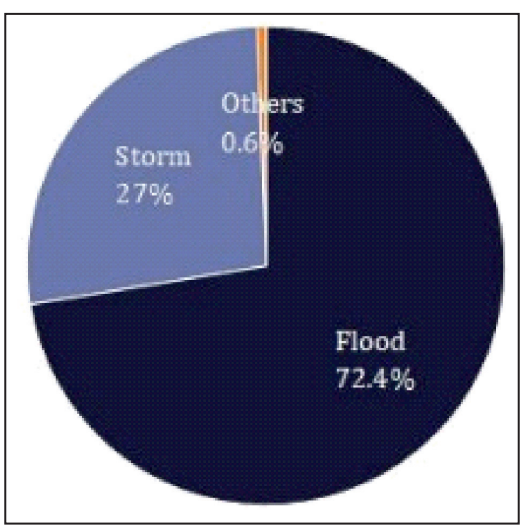

Figure 1: Share of internal displaced population (%) by type of natural disasters in India, 2011-2021.

Source: Internal Displacement Monitoring Centre

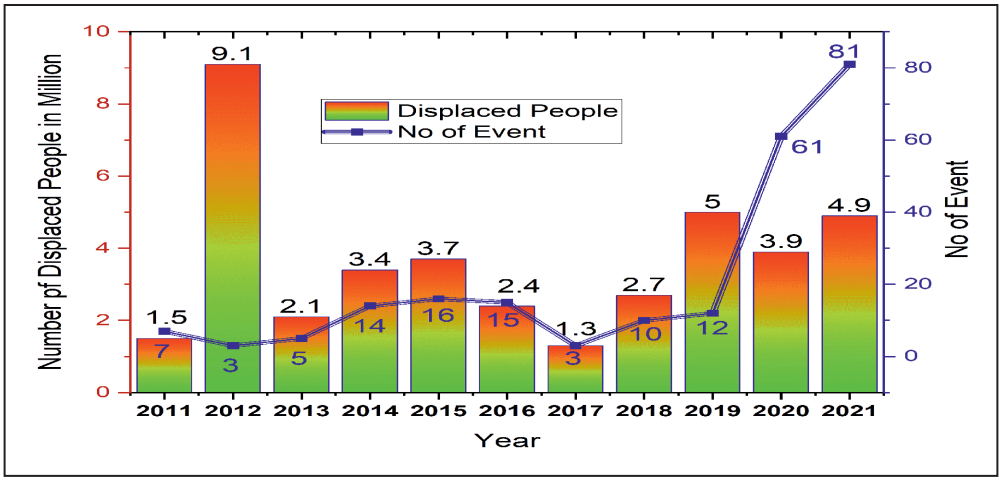

Figure 2: Temporal change in number of internal displaced population (IDP) and number of natural events due to any natural disaster in India, 2011-2021

Source: Internal Displacement Monitoring Centre

The temporal change of IDP due to natural disasters is found to be heterogeneous, with the highest displacement occurred in 2012 (9.1 million). There is no marked visualization in the relation between the number of internal displacements and events (Figure 2). Since 2019, the number of natural occurrences has sharply increased and resulted in significant internal displacements.

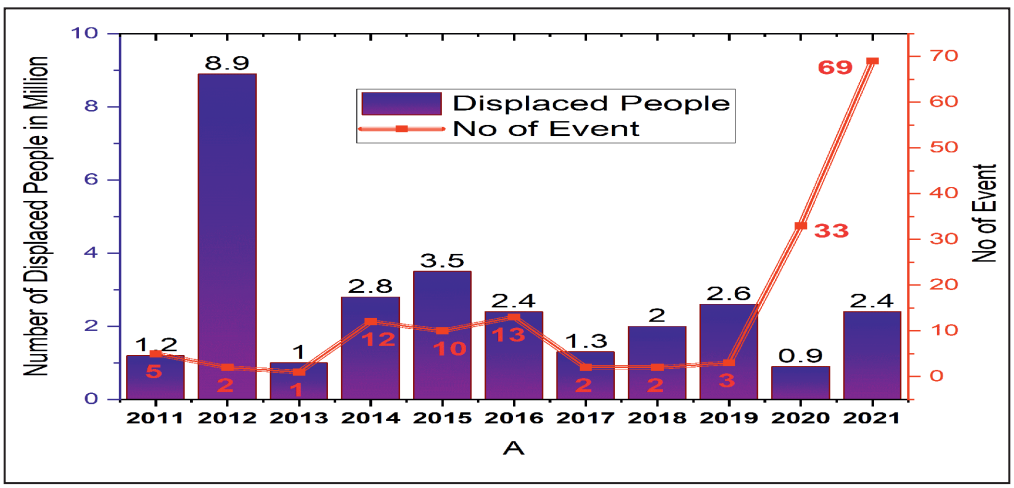

Figure 3: Temporal change in number of internal displaced population (IDP) due to flood in India, 2011-2021

Source: Internal Displacement Monitoring Centre

The number of IDP was found asymmetrical in nature with selected years, and observed highest in 2012 (8.9 million), followed by 3.5 million in 2015. However, more than 1 million parsons were experienced internal displacement every year. At the same time, the occurrence of flood was found also irregular in nature; however, it was sharply increased during 2019-2021 (Figure 3). The incidence of internal displacement largely occurred due to floods in India, pre-dominantly in the Gangetic and Brahmaputra flood plains of this country, with almost 28 million between 2011 and 2021 (see. Table 3). Out of total 227 of natural events, 152 were flood events, and nearly half of the flood events occurred in 2021, with 2.4 million internally displaced people in India (see. Table 2).

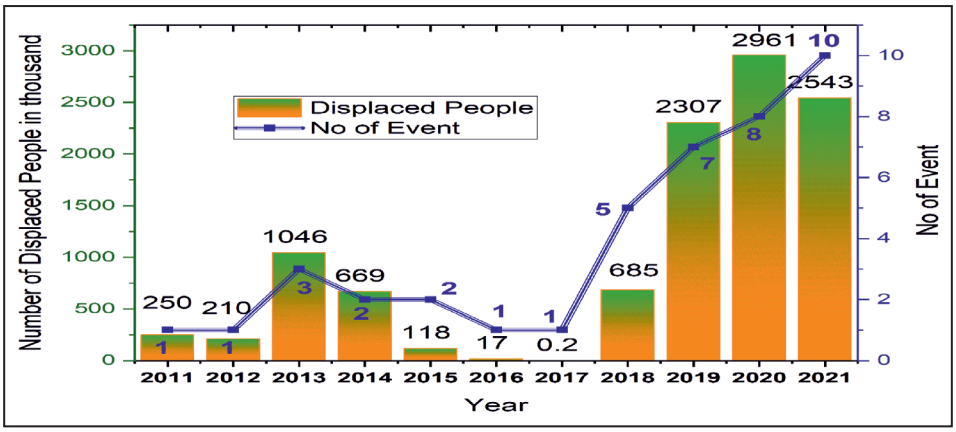

Figure 4: Temporal change in number of internal displaced population (IDP) due to cyclone in India, 2011-2021

Source: Internal Displacement Monitoring Centre.

The number of cyclonic events was significantly increased during 2017-2021. At the same time, the number of IDP due to cyclone also increased proportionally. The number of cyclonic events was two times increased, and internal displacement increased almost four times during the same period of time (Figure 4). In particular, 250 thousand of the population were displaced due to severe storms in 2011, reached to 1046 thousand in 2013, and 2543 thousand in 2021.

In figure 5, it is also found fewer displacements due to other natural hazards (cloudburst, drought, dry mass movement, earthquake, landslide, wet mass movement, and wildfire) compared to floods and storm-related displacement in India. In sum, 2.35 million people were displaced due to other natural hazards, with 34 events in India during 2011-2021. In India, major displacement due to other natural hazards occurred in 2011, with 75 thousand displacements, followed by 56 thousand in 2013 and 63 thousand internal displacements in 2019.

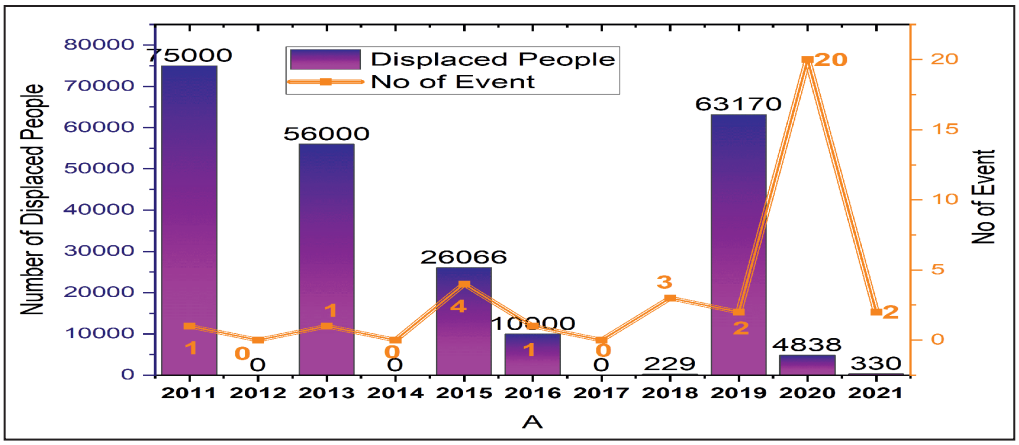

Figure 5: Temporal change in number of internal displaced population (IDP) due to any other natural disasters in India, 2011-2021

Source: Internal Displacement Monitoring Centre

Table 1: Present the different types of hazards and displaced person in India, 2011-2021

Types of hazards	*No of events*	*Sub-category*	*Displaced persons*	*Effected States*
Flood	Total= 152	Monsoon Flood (141)	28891542	AS, OD, MP, MH, UP, BR, CH, AP, UK, KL, WB, ANP, HP
		Flash Flood (10)	103230	TR, MG, ML, MH, KR, TL, UK, HP, JK, RJ,
		Dam release flood (01)	840	TN
		Total (152)	28995612	
Strom	Total= 41	Hailstorm (03)	5520	UP, TR, MZ
		Tropical Cyclone (34)	10675505	OD, AP, WB, MH, GJ, MN, MG, KL, TN
		Thunderstorm (02)	6100	UP, AP, WB, DL, TR
		Tornado (01)	100	OD (Kendrapara)
		Nor'weste (01)	118000	BR
		Total (41)	10805225	
Others	Total=34	Earthquake (5)	166010	SK, WB, BR, JK, AP
		Landslide (26)	6534	AS, AP, UK, WB, JK, BR, SK
		Wildfire (02)	89	HP (Kangra &Dangeni village)
		Drought (01)	63000	India: drought - 19 states - 01/01/2019
		Total (34)	235633	
Total (227)			40036470	

Note: AS= ASSAM, OD= ODISHA, MP= MADHYA PRADESH, MH= MAHARASTRA, UP= UTTRA PRADESH, BR= BIHAR, CH=CHHATTISHGARGH, AP= ANDRA PRADESH, UK= UTTARKHAND, KL= KERALA, WB=WEST BENGAL, ANP= ARUNACHAL PRADESH, TR= TRIPURA, MG= MEGHALAYA, KR=KARNATKA, TL=TAMIL NADU, HP= HIMACHAL PRADESH, SK= SIKKIM, JK=JHARKHAND, GJ= GUJARAT.

Figure 6(a) presents the number of persons displaced due to overall natural disasters—a state-level representation of internally displaced people in India between 2011 and 2011. The emergence of North-Eastern, Eastern, and South Indian states as more displacement occurring for people was noticeable. It has been observed that the highest number of displaced people reported in the last ten years in the North-Eastern state of Assam, 141 lakhs, followed by the Eastern state of Bihar, 64 lakhs, Odisha 64-lakhs, and West Bengal 34-lakhs. In the Southern states of India, Andhra Pradesh, 35-lakhs have reported a higher number of displaced populations, followed by Tamil Nadu, 22 lakhs. Of the West Indian states, only the state of Maharashtra reported the number of internally displaced population, which stood at 07-lakhs. Further, in north India, the state of Jammu and Kashmir experienced 09-lakhs population displacement in the last ten years. The eastern state of Jharkhand also experiences a considerable volume of displacements due to overall natural disasters with a 08-lakhs population. Moreover, the states like Kerala, Karnataka, Gujarat, and Sikkim also reported a significant volume of internal displacement in India. It can be noted that Gangetic and Brahmaputra flood plains and the coastal state of Odisha have a huge number of internally displaced people; further, it is found that Eastern coastal states have reported a greater number of displaced populations in comparison to Northern, Central, and Western states of India.

Figure 6(b) presents the spatial distribution of the internally displaced population due to floods in the states of India between 2011 and 2021. It has been found that the North-Eastern state of Assam and the Eastern state of Bihar were badly affected by the flood, with 141-lakhs and 63-lakhs internally displaced populations, respectively. The study further noticed that the South Indian states of Andhra Pradesh, 21 lakhs, and Tamil Nadu, 15-lakhs, had reported a considerable volume of internally displaced population due to floods in the last ten years. Moreover, in the Eastern state of Odisha, 21-lakhs and West Bengal reported a 08-lakhs internally displaced population during the study period. In North Indian states, only Jammu & Kashmir experienced significant internal displacements due to floods between 2011 and 2021. However, most North-Western States have experienced fewer flood events and reported less internal displacement than the rest of India. Here also, the Ganges in Bihar and flood plain areas of Assam have a greater number of internally displaced people, followed by Eastern coastal states bordering the Bay of Bengal. As the occurrence of flood in Central and Northern India are not much, therefore the number of the internally displaced population reported in these states of India are comparatively low. However, Maharashtra in the Western part of India and Jammu & Kashmir in Northern India has also reported a considerable number of internally displaced people.

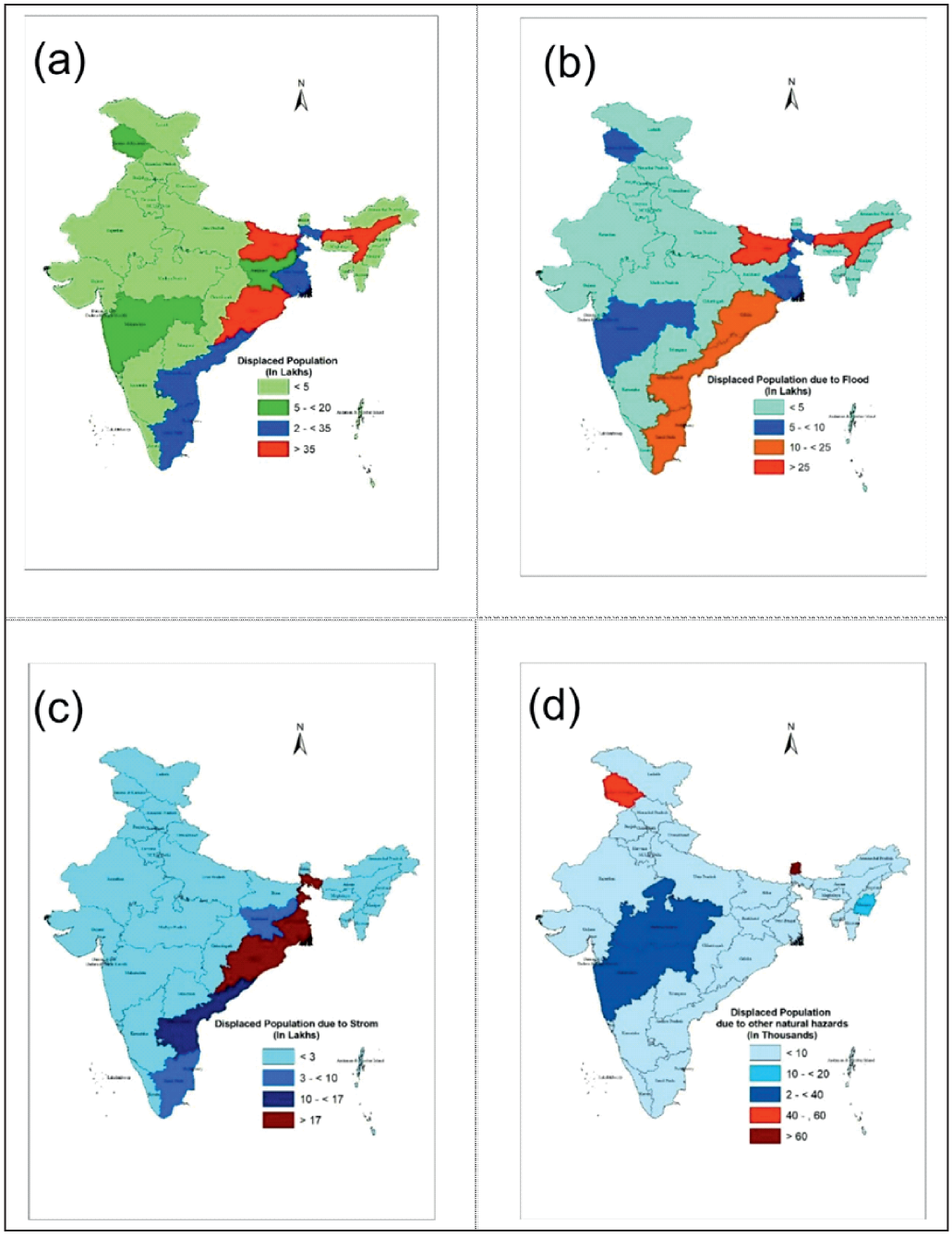

Figure 6: Spatial distribution of internal displaced population (a) by all natural disasters, (b) by flood, (c) by cyclone, and (d) by other natural disaster in India

Source: Internal Displacement Monitoring Centre

Figure 6(c) gives the spatial distribution of internal displacement due to storms for India's states between 2011 and 2021. It is found that Eastern states Odisha and West Bengal are the most storm-experienced states; as a result, 43-lakhs and 26-lakhs populations has displaced in the last ten years, respectively. It may be noted that another storm-affected state is Andhra Pradesh, which reported 14-lakhs internal displacement in the last ten years due to the frequent hitting of different severe cyclones. Further, the state of Tamil Nadu in the Southern part of India and Jharkhand in the Eastern part has also reported a significant number of internally displaced people due to severe storms and cyclonic events. Thus, it has been noticed that the Eastern coastal states of India are prone to storm-related displacement.

Figure 6(d) illustrates the spatial distribution of the internally displaced population due to other natural disasters in India from 2011 to 2021. This shows that other natural disaster-related displacement is concentrated in hilly areas than the other zone in India. The north-eastern state of Sikkim reported the highest displacement due to other natural disasters between 2011 to 2021. Further, it has also been observed that other hilly states, Jammu, Kashmir, and Manipur, registered higher displacements in the last ten years. The central Indian states of Madhya Pradesh and the Western states of Maharashtra have reported much displacement during the study period.

Discussion

The present study examined the temporal change and spatial distribution of internally displaced people due to different natural disasters in India using a globally representative data set of the Internal Displacement Monitoring Centre. The core findings of the study include: Firstly, the occurrences of natural disasters increased ten times for each natural event in India during 2011-2021, which is two times higher than the global average (Secretariat, W. M. O., 2022). Findings suggest that the most affected areas due to natural disasters are Assam in North-East India, Bihar in Eastern India, Odisha in the Eastern coastal region, and West Bengal in Eastern Region. In these states, the flood is predominantly high in the Middle Ganges, the Brahmaputra, and Kaveri, Krishna, and Mahanadi River catchment areas suggested by many previous studies (Renaud, F. G., 2011: 5-29). Furthermore, the severity and intensity of floods also increased over the time due to anthropogenic reasons (Stefanidis, S., and Stathis, D., 2013: 569-585).

Secondly, flood is a leading cause of internal displacement in India. The effect of floods has doubled; however, the displacements caused by storms tend to be upward over time. Of all the natural disasters, floods are by far the most dangerous, common, and widespread events worldwide (Loebach, P., 2016: 203-219). Additionally, it has

been discovered that floods are the natural disasters that result in the greatest number of fatalities, followed by tropical cyclones, earthquakes, and droughts (Mallick, B., 2017: 13; Dhar and Nandargi, 2003: 1-33). Indian regional level literature also suggested that the vulnerability of internal displacement is significantly associated with floods in the Brahmaputra River basin in Assam (Bora and Boruah, 2021: 723-729), Middle Ganga and Kosi flood plain in Bihar and Uttar Pradesh (Gangwar and Thakur, 2018: 76-92), the lower catchment area of Mahanadi, Godavari, Krishna, and Kaveri in the eastern and south-eastern coastal belts. The degree of flood-induced internal displacement is higher mainly due to the areal extension of the flood plain area being significantly higher than the areal extension of the cyclone and other disasters in India (Dikshit, K.R., and Dikshit, J.K. 2014). The population density is also high in floodplain regions due to fertile land suitability for agriculture, which is positively associated with higher exposure to flood-induced displacement. Both natural and anthropogenic causes are responsible for the devastating and frequent nature of floods in India, such as sheet erosion and rapid sedimentation due to deforestation (Thirumurugan and Krishnaveni, 2019: 1-17), variability in monsoon rainfall (Bhalme and Mooley, 1980), river bank erosion (Sahoo, B., and Bhaskaran, P. K., 2015: 389-396). However, the upward trend of atmospheric events (cyclones) in India found in the study may impact global climate change. This changing phenomenon increases the risk of internal displacement vulnerability in India, particularly in the east coastal region.

Thirdly, the spatial pattern of the reason behind displacement significantly varied with space; flood-induced displacement is mainly prevalent in the Middle Ganges and Brahmaputra flood plains and eastern coastal regions prone to flood and storm displacement. The internal displacement is a well-defined issue in the Middle Ganges, and the Brahmaputra suggested by many previous studies; however, the vulnerability of internal displacement is proportioned to the severity of the floods (Kale, V. S., 2003: 65-84; National Remote sensing Centre, 2020). For example, the flood severity in Bihar and Assam in 2012 was most ruinous, resulting in remarkable internal displacements. The occurrence of cyclonic events increased over time, which turns the dual burden of disasters (both flood and cyclone) in the Eastern and south-eastern coastal Both seasonal variability of monsoon wind-related atmospheric disturbances, and tropical cyclone increases the frequency of cyclone in the region and positively associated with noticeable natural, economic loss, and displacement. The deadliest cyclone 'Yaas' caused the collapse of multiple coastal embankments, which submerged agricultural lands and caused power shortages, as well as the collapse of mud huts in Odisha and West Bengal (Paul and Chowdhury, 2021: 219-235). It has been observed

that the Krishna, Godavari, Mahanadi, and Hooghly River deltas along the coast are particularly vulnerable to pressure differences during cyclones, which results in cyclone landfall in the river confluences and the encroachment of salty sea water, forcing people to flee the area (Rao, *et al.*, 2020: 39-57).

Finally, the displacement due to other disasters is very low and mainly concentred in the Himalayan region and central pocket of Maharashtra. Moreover, in the present study, patterns suggest that the displacement of people due to other natural disasters has increased in recent years. Displacement due to other causes (like drought, landslides, and mass movement) is comparatively low and concentrated in the Himalayan and central-western regions of India. Displacement due to landslides and mass movement has been observed, particularly in North-East India and North India. (i.e., Sikkim, Manipur, Jammu & Kashmir). However, drought-related displacement has been found in parts of Western and Central India (i.e., Maharashtra and Madhya Pradesh). Previous studies suggested that the risk of internal displacement resulting from landslides and mass movement is insignificant in India because the region is sparsely populated due to geographical remoteness (Fernandes, 2013: 287-305).

Major findings and policy implications

Demarcation of disaster-prone regions is an utmost necessity of the time. States with greater severity of natural disasters should equipped with disaster alert systems. Further, resettlement programme for the population of the high-risk zone and mobile settlement can be implemented in the disaster-prone zones. Moreover, developmental activities (e.g., construction of roadways, and dam) in hilly regions should avoid the populated areas of Jammu & Kashmir, Sikkim and North-Eastern states. Further, drought-prone areas should be encouraged with alternative agricultural practices and water harvesting systems (Rajeev, 2016). Indeed, the displacement intensity is greater for flood events than storms; the Indian and state governments must make additional efforts to reduce risk and manage retreat for people threatened by flooding because flood occurrences last longer than cyclone events. If managed appropriately, relocating communities away from dangerous places is a potentially effective adaptation option for offering alternatives to physical protection. However, considering the size of the expected displacement and the difficulties in resettling entire communities, relocation plans face numerous obstacles. Overall, current local and regional strategies cannot handle the difficulties of migration and displacement brought on by natural disasters. There is a need for more forward-looking national and local policies on pre-emptive managed retreats for at-risk populations. The displacement has primarily been addressed as post-disaster response.

Limitations

As the Internal Displacement Monitoring Centre data consists of the number of people displaced due to events only, there is no socio-economic or background information related to displacement. Since 2017 number of cyclone events has sharply increased, which has positively contributed to internal displacement, but there is no information on climate change. Further, an extension of the work can be done with additional data from Indian Metrological Department and National Disaster Management data to study the internal displacement scenario in India. Further, it can be noted that displacement due to flood depends on coverage and severity in a river basin, and displacement due to cyclone depends on landfall areas as the cyclone is an atmospheric phenomenon with no defined coverage. Therefore, a study can be done across South Asian countries based only on flood and cyclone events.

Conclusions

It can be concluded that, between 2011 and 2021, an average of 3.6 million Indians were uprooted annually, the majority due to flooding brought on by monsoon rains that are, in terms of absolute intensity, the strongest in South Asia. While the majority of India's current disaster mitigation and rehabilitation strategies deal with displacement caused by rapid-onset disasters like floods and cyclones, displacement caused by slow-onset disasters like drought in Central India also states other disaster-related displacements in three pocket states (e.g., Sikkim, Jammu & Kashmir, and Manipur) has yet to be addressed at the policy level. As the intensity and frequency of disasters rise in the future due to the challenges posed by climate change, it will be impossible to avoid the relocation of many human settlements as a preventative disaster management strategy, necessitating the development in India of a national-level policy on managed retreat. The government can demarcate the states as safe and risk zones based on the severity of natural disasters.

References

Adger, W. N., de Campos, R. S., & Mortreux, C. (2018). "Mobility, displacement and migration, and their interactions with vulnerability and adaptation to environmental risks". In *Routledge handbook of environmental displacement and migration* (pp. 29-41). Routledge.

Bhalme, H. N., & Mooley, D. A. (1980). "Large-scale droughts/floods and monsoon circulation".

Bora, P., & Boruah, A. (2021). "Flood and erosion induced settlement displacement: A study In Morigaon District, Assam". *Information Technology in Industry*, *9*(3), 723-729.

Das, M., Das, A., Momin, S., & Pandey, R. (2020). "Mapping the effect of climate change on community livelihood vulnerability in the riparian region of Gangetic Plain, India". *Ecological Indicators*, *119*, 106815.

Debnath, M., & Nayak, D. K. (2020). "Assessing drought-induced temporary migration as an adaptation strategy: Evidence from rural India". *Migration and Development*, 1-22.

Devakumar, J. (2008, January). "Internal Displacement in Contemporary India: Homeless in Their Own State". In *Proceedings of the Indian History Congress* (Vol. 69, pp. 1211-1225). Indian History Congress.

Dhar, O. N., & Nandargi, S. (2003). "Hydrometeorological aspects of floods in India". *Natural Hazards*, *28*(1), 1-33.

Dikshit, K.R., Dikshit, J.K. (2014). "Population of the North-Eastern States of India. In: North-East India: Land, People and Economy". Advances in Asian Human-Environmental Research. Springer, Dordrecht. https://doi.org/10.1007/978-94-007-7055-3_12

Fernandes, W. (2013). "Internally displaced persons and northeast India". *International Studies*, *50*(4), 287-305.

Gangwar, S., & Thakur, B. (2018). "Disaster, Displacement and Rehabilitation A Case Study of Kosi Floods in North Bihar". *National Geographical Journal of India*, *64*(1-2), 76-92.

Hussain, M. (2006). "Internally Displaced Persons in India's North-East". *Economic and Political Weekly*, 391-393.

Jha, A. K. (2013). "Retracted: Climate change and internal migration in India: Response of the state, market, and the civil society". *Poverty & Public Policy*, *5*(2), 133-145.

Kale, V. S. (2003). "Geomorphic effects of monsoon floods on Indian rivers". In *Flood problem and management in South Asia* (pp. 65-84). Springer, Dordrecht.

Kothari, U. (2014). "Political discourses of climate change and migration: resettlement policies in the Maldives". *The Geographical Journal*, *180*(2), 130-140.

Loebach, P. (2016). "Household migration as a livelihood adaptation in response to a natural disaster: Nicaragua and Hurricane Mitch". *Population and Environment*, *38*(2), 185-206.

Mallick, B., & Vogt, J. (2014). "Population displacement after cyclone and its consequences: Empirical evidence from coastal Bangladesh". *Natural hazards*, *73*(2), 191-212.

Mallick, B., Ahmed, B., & Vogt, J. (2017). "Living with the risks of cyclone disasters in the south-western coastal region of Bangladesh". *Environments*, *4*(1), 13.

National Remote sensing Centre. (2020). "Flood Hazard Atlas-Bihar: A Geospatial Approach". *Government of Bihar*, Version 2.0.

Panda, A. (2020). "Climate Change, Displacement, and Managed Retreat in Coastal India". *Retrieved from Migration Policy Institute: https://www. migrationpolicy. org/article/climate-change-displacement-managed-retreat-india*.

Paul, S., & Chowdhury, S. (2021). "Investigation of the character and impact of tropical cyclone Yaas: a study over coastal districts of West Bengal, India". *Safety in Extreme Environments*, *3*(3), 219-235.

Rajeev, M. M. (2016). "Disaster and Displacement: The Indefinable Consequences on Human, Social and Cultural Capitals". *Development, Displace*.

Rao, A. D., Upadhaya, P., Ali, H., Pandey, S., & Warrier, V. (2020). "Coastal inundation due to tropical cyclones along the east coast of India: an influence of climate change impact". *Natural Hazards*, *101*(1), 39-57.

Renaud, F. G., Dun, O., Warner, K., & Bogardi, J. (2011). "A decision framework for environmentally induced migration". *International Migration*, *49*, 5-29.

Sahoo, B., & Bhaskaran, P. K. (2015). "Synthesis of tropical cyclone tracks in a risk evaluation perspective for the east coast of India". *Aquatic Procedia*, *4*, 389-396.

Schmeidl, S., & Hedditch, K. (2018). "Changing patterns of internal displacement: The art of figure skating". In *Demography of Refugee and Forced Migration* (pp. 177-199). Springer, Cham.

Secretariat, W. M. O., (2022). "Early Warning and Anticipatory Action". *The journal of the World Meteorological Organization*, Volume 71 (1).

Shi, P., Wang, J. A., Xu, W., Ye, T., Yang, S., Liu, L., ... & Wang, M. (2015). "World atlas of natural disaster risk". In *World Atlas of natural disaster risk* (pp. 309-323). Springer, Berlin, Heidelberg.

Singh, O., & Kumar, M. (2013). "Flood events, fatalities and damages in India from 1978 to 2006". *Natural hazards*, *69*(3), 1815-1834.

Stefanidis, S., & Stathis, D. (2013). "Assessment of flood hazard based on natural and anthropogenic factors using analytic hierarchy process (AHP)". *Natural hazards*, *68*(2), 569-585.

Thirumurugan, P., & Krishnaveni, M. (2019). "Flood hazard mapping using geospatial techniques and satellite images—a case study of coastal district of Tamil Nadu". *Environmental monitoring and assessment*, *191*(3), 1-17.

Wadini, P. (2019). "Disaster and Large-Scale Population Displacement: World and Indian Scenario". *International Journal of Innovative Studies in Sociology and Humanities*, *4*(10), 16-22.