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Exploring Cultural Identity: Perspectives from Social Sciences and Humanities

A comprehensive review of methodologies and implications for evaluating flood susceptibility

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Abstract Floods, ever since the dawn of human civilization, have been seen as causes of massive disasters. Since its onset, the influence of human activity has increased, making this calamity more severe. Vulnerability to flooding is complex and multifaceted and it is a matter of critical importance. Since the scale of damage changes with location and with time, determining how susceptible a community is to flooding is of paramount importance. The research is an effort to summarize the methods developed to evaluate flood risk. By examining the authors and terms most commonly cited in the works of others, actionable tactics were uncovered. High-resolution data and a multidimensional approach to vulnerability assessment can enhance current procedures and strategies for estimating flood risk. This research recommends merging hydrodynamic models, geospatial methodologies for flood assessment to present a more complete view of flood vulnerability. It is potentially helpful in identifying methodological inadequacies for measuring flood risk at various geographical scales. The study analyzes several vulnerability components. This research has the potential to fill critical knowledge gaps in our understanding of how to measure exposure to flood risk across a variety of geographical scales.

Keywords: flood susceptibility, vulnerability, disaster, Flood Susceptibility Mapping (FSM)

1. Introduction

The most frequent and costly natural disasters are floods. Deforestation, altered land use, overgrazing of rangeland and population growth contribute to an increase in flood risk and incidence, as do the urbanization and riverside construction have resulted from these factors. Furthermore, climate change can exacerbate floods due to the increased frequency of extreme weather and major storms (Azareh et al 2021). Dangerous frequent natural catastrophic events, floods generate considerable deaths and socioeconomic damage. While there is no way to avoid flood damage, precautions can be taken to lessen the impact (Li et al 2020). The majority of the rivers in eastern India are seasonal. This area experiences flooding due to monsoonal precipitation or storm currents. Evidence from history and current weather patterns show that modern-day climate change is linked to floods (Roy et al 2020). Future severe flood occurrences will become more common due to climate change and urban expansion. Figuring out how well one mitigation strategy performs compared to another calls for an in-depth familiarity with the physical and non-physical components causing damage to floodplain elements. Damages from floods can be assessed in two ways: directly and indirectly. Physical items can suffer direct damage as they are submerged in water and indirect damage can result from direct damage sustained during or after a flood (Paulik et al 2022). However, with flood susceptibility mapping (FSM), they anticipate future flood occurrences and assist in lessening their human and societal economic damages. The government has used FSM, a much-unstructured method, to ensure the safety of its citizens and the preservation of their property (Islam et al 2021). The natural and human ecologies are affected by floods. Ecosystems benefit from it to some extent because of the water and nutrients it brings to the riparian corridor, the pollution it flushes out of flood plains, the groundwater it recharges and the soil fertility it improves. When water levels rise over the safety threshold, they threaten people's lives, businesses, homes, forests and rivers (Mahato et al 2021). Worldwide, flooding is a leading cause of death and destruction due to natural catastrophes. Natural occurrences, including heavy and prolonged rain, landslides, changes in temperature, land use and the overflowing of glacial lakes cause most flood risks. Anthropogenic causes, such as faulty dam building, riverbank encroachment and urbanization, contribute to flood intensity (Chaulagain et al 2023). When rivers burst their banks and flood the land around them, a flood has occurred. Many of the world's worst natural catastrophes, such as floods, are caused by the accumulation of precipitation or snowmelt over an extended period, compounded by adverse geo-environmental circumstances (Saha et al 2021). Glacial lakes are found across the Himalayas and grow as a cause of glaciers melting due to global warming. There are notable distinctions between these glacial lakes in their genesis, dam construction, longevity, size, appearance, disappearance and aftermath of bursting (Khadka et al 2021). Because of the destruction they inflict on transportation, human life and urban infrastructure in highly populated areas, floods are among the most catastrophic natural catastrophes. In contemporary cities, because of the quick run-off from concreted and asphalted surfaces, heavy rains can create large flooding, which can overwhelm storm drains and drainage systems (Rafiei-Sardooi et al 2021). Using a logistic regression model fed by remote sensing data (RS) and a GIS, this research hopes to pinpoint vulnerable locations to flooding. Utilizing ten predictive criteria, a flood inventory was created utilizing 153 identified flood areas. The Area under the Curve (AUC) method was used to validate the model, which included splitting the flood data into training (75%) and testing (25%) sets. Flooding is a destructive natural disaster that affects people, property and the environment (Mind'je et al 2021). Online news, blogs and government sites were accounted. This susceptibility map was generated using a logistic regression model that considered many independent slopes, flood-related parameters, curvature, elevation, wetlands degradation, land use and land cover, including precipitation normalized differential vegetation index (Zeng et al 2020). Researchers in Karachi assessed the causes of flooding and pinpointed the areas at risk of water damage. To create the vulnerability map and analyze potential variables, an ensemble model Logistic Regression - Support Vector Machine - Multi-Layer Perceptron (LR-SVM-MLP) is presented. In terms of property damage, floods are at the top. That's why their forecast is important for flood control and protecting the public. The features of each watershed determine the factors that contribute to flooding in that watershed (Yaseen et al 2022). Using population data and past flood hazard statistics, they developed a methodology for determining the extent to which different vulnerability types contribute to economic considerations in a given area. Adaptability and susceptibility have been linked to economic and social-demographic characteristics in several of these studies. However, their connection has not been investigated (Deria et al 2020). One of nature's most terrible calamities, floods are damaging for economically unstable countries like Bangladesh. Predicting where flooding will occur is challenging for flood control because of the fluid and complicated character of floods (Talukdar et 2020).

2. Methods

This study employs a methodical strategy by using the "Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)" framework. PRISMA has been accepted by experts in environmental management to utilize coordinating systematic reviews. This search was conducted using many electronic databases. These included Springer Link (n=55), Science Direct (n=48), JSTOR (n=25) and Web of Science (n=160). After removing the duplicates, there were 288 records from the initial 280. 230 items were disregarded following the title/abstract screening. After 50 full-text publications were scrutinized for eligibility, 25 full-text articles were missed due to the lack of any outcomes of mortality, interest and illness progression, including severe ARDS. All 27 studies had 5349 participants. Figure 1 shows a subset of the 25 papers used in the qualitative synthesis and meta-analysis.

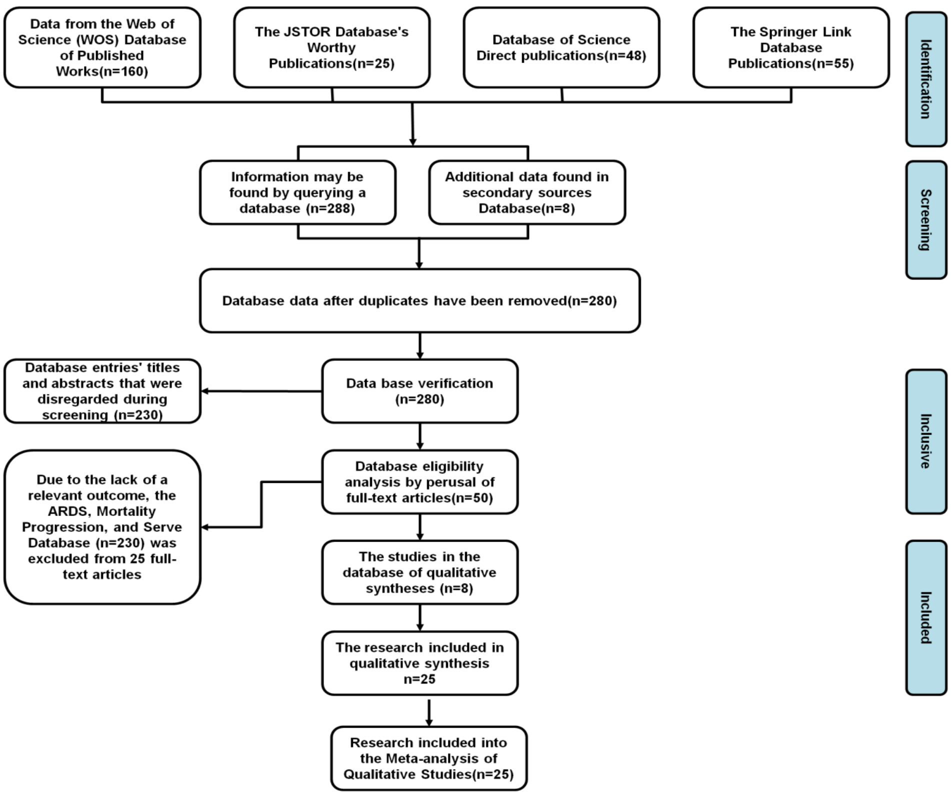

Figure 1 Study selection using PRISM.

2.1. Researchers' perspectives on vulnerability's definition and conceptualization

The first effort to identify vulnerability has been identified via a review of existing research. Who emphasized the need to research 'vulnerability' and the circumstances around it. Sensitivity to weather is modified by its size, pace, variability and extremes (Faeghi and Roche 2019). There is a strong connection between climate change and susceptibility. Different settings have varying degrees of vulnerability and resilience. Analysis of exposure and requirements on a regional scale has been determined to be crucial (van der Geest and Warner 2020). Vulnerability is defined as being at risk and having a diminished capacity to react to various environmental threats, both for individuals and communities. Cutter continued by saying that an interdisciplinary approach is required to show the intricate linkages between many systems (natural, social and engineering) that make up the science of vulnerability (Guo and Kapucu 2020).

2.2. Comprehensive literature review on the topic of flood risk

2.2.1. Risk of flooding as a conceptual framework

When individuals or a whole area are vulnerable to flooding, they are susceptible to its effects and cannot recover quickly. Evaluation and assessment of flood risk need an understanding of flood susceptibility. Vulnerability can help in flood control and lessen the impact of flooding on different parts of society. Risk, exposure and sensitivity are a few features that make up the multifaceted notion of vulnerability (Rehman et al 2019). This means that the susceptibility of individuals, events and communities to floods, as well as their capacity to recover from their effects, is related. Different factors, such as the magnitude of the flood event, the degree of risk connected with the hazard and the costs of the resulting damage, all contribute to a community's susceptibility to flooding (Hussain et al 2021). It's crucial to underline the potential for substantial environmental, social and economic consequences while explaining the concept of flood risk. Deterministic approaches employ physically based models to estimate the probability of flood hazard and flood losses, allowing for an evaluation of the monetary effect of flood risk in a location (Garrote et al 2021).

2.2.2. Vulnerability to flooding may be evaluated using a variety of techniques

For decades, efforts to lessen the impact of floods have been a point of focus. That's why the field of flood risk management must investigate issues of risk perception, risk assessment and risk communication. Some academics have developed novel techniques for quantifying flood damage (Lechowska 2022). There has been a recent uptick in using high-resolution microwave data, such as that collected by an advanced land imager (ALI), to analyze flood susceptibility. The study of local flood inundation has benefited from high-resolution aerial radar data (Islam and Ahamed 2023).

2.2.3. An analysis of the literature on flood risk and vulnerability in underdeveloped countries

Academics have been interested in studying the vulnerability of developing countries and the impacts of floods (Brennan et al 2021). Many developing countries are vulnerable to flooding because of the wide range of climatic types. As a result, many hydrodynamic models have been developed in these countries to examine floods of varying types (Ou et al 2022).

2.3. Multiple factors contribute to flood risk

2.3.1. Ecological precariousness

Floods have a long history of causing widespread damage to people and their surroundings. They emphasized the danger caused by climate change, flooding and cyclones. One crucial aspect of vulnerability is one's ecological impact. Sustainable development, usefulness and adaptability were proposed as critical indicators of ecological fragility (Jozaei et al 2022). Ecological vulnerability can be broken down into its constituent parts, such as the species involved, the kind of ecosystem and the physical features of the area (Chan et al 2022). Assessing ecological vulnerability requires thinking about how different species will respond to changes in climate or the effects of an event (Kumar et al 2021). The capability of the wetland to mitigate flood damage was evaluated using a model based on fuzzy interval-stochastic programming (MIFISP). The ecosystems of wetlands are shaped through their topography and hydrology (Rehman et al 2021).

2.3.2. Vulnerability in social contexts

Numerous academics have analyzed and evaluated how susceptible society is to climate change and its attendant catastrophic occurrences. The conditions under which people and other socio-cultural groups make adjustments in response to climate change are intrinsic to resilience and social adaptation, which is primarily linked to economic activity and the nature of wetlands. (Roy et al 2021). Vulnerability in one's social group can have a significant impact on one's capacity to provide for oneself and one's family. In terms of income, lack of access to resources and the resulting social, ecological and economic issues, the vulnerable groups can be defined. Susceptibility to flooding rather than relying on strict deterministic methodologies, flood risk management has shifted its emphasis on societal vulnerability and the use of technological solutions (Gaynor et al 2021).

2.3.3. Instability in the economy

Natural disasters hurt the economy and can cause disruptions to people's daily lives. Floods are notorious for wreaking havoc on infrastructure and building resilience to these catastrophes is expensive and time-consuming. Several studies around the globe have linked floods to widespread economic precocity (McEntire 2021). The GIS visualization of this financial fragility has helped to pinpoint susceptible areas. The most important indicators of financial vulnerability are housing conditions, demographics and income. Therefore, income and wealth are relevant metrics by which they assess economic vulnerability (Grimaccia and Naccarato 2019).

2.4. Comparing loss estimation using engineering vs. economic methods

The costs of flood occurrences can be calculated in several different ways each grounded in either civil engineering or economics. Most of the literature on flood event effects and structural mitigation comes from engineering research. While catastrophes were thought to be the result of physical processes, this perspective has shifted in recent decades to include vulnerability as a critical factor in how susceptible assets and people are to the effects of hazards (Taghinezhad et al 2021).

2.4.1. Studies in Civil Engineering: Stock Depletion

Sophisticated hazard models have been created, but for a long time, engineering studies have dominated the catastrophe risk assessment literature. Engineering studies are limited because (i) they include monetary losses and (ii) they don't use non-market valuation methods to account for intangible costs (Paprotny et al 2021). Another repercussion of labeling expenses as 'intangible' is that engineering evaluations can't sum up a wide range of cost types in monetary terms. As a result, it's essential to break down the costs by category based on factors like number of lives lost and the dollar amount of property damage. Instead, economic approaches can aggregate costs across different cost categories, making them valuable for policy assessments that compare different risk-mitigation strategies **(**Manfreda and Samela 2019). Changes in land use, population, asset value and susceptibility are some socioeconomic factors seldom accounted in engineering flood risk assessments. Socioeconomic aspects are taken for granted as constants. However, there is growing attention to the need to assess catastrophes' societal and economic effects. In particular, there has been a rise in the number of engineering studies focusing on the impact of disasters on essential services and infrastructure (Chang et al 2019).

2.4.2. Studies in Economics: Flow Diminishment

The financial impact of natural catastrophes has been the subject of academic inquiry for almost thirty years. Although early research focused on property losses from floods and sea level rise, more recent study has begun to account for a broader range of catastrophe costs. Estimating flow losses, such as shifts in production, income, or consumption, is a primary goal of most economic assessments. Econometric, I-O and CGE models are common approaches for estimating losses. It's essential to remember that floods are included in the reviewed economic research (Mendelsohn et 2020). Some econometric studies ignore catastrophe severity since they consider a binary indicator of disaster incidence. Due to the wide range in physical catastrophe size, omitted variable bias can be substantial. This is evolving as more research takes catastrophe severity into account (Lorie et 2020).

2.4.3. Costs of flooding: reconciling several definitions

When calculating the financial tax of floods, there is no gold standard. The ad hoc effects of floods and other natural calamities are not recognized by a shared lexicon (Langill and Abizaid 2019). In this article, "costs" refers to the expenses spent before and after a catastrophe. It includes measures taken to be ready for it. Flood "losses" are the after-the-fact expenses associated with the disaster, whereas "damages" simply pertain to the actual physical destruction of property (DjoumessiTiague 2023).

2.4.4. Flood Susceptibility assessment based deep Learning method

Figure 2 and Table 1 "[Source: https://www.mdpi.com/2072-4292/14/24/6360]" show the results of their quantitative analysis of the five susceptibility models (RF, SVM, Swin-T, CNN and DNN) used in both training and validation sets. On both training sets, Swin-T (Yang et al 2022) had the highest accuracy, followed by SVM, CNN, RF, DNN and finally Swin-T (Yang et al 2022). On both the training set and the test set, the random forest model achieves the highest possible accuracy, 97.27% and 96.55%, respectively. However, CNN (Yang et al 2022) had the maximum recall (97.48%) of any model on the justification set. Other than that, Swin-T (Yang et al 2022) was unbeatable in every respect. It achieved the highest recall (100%) and F1-score (96.05%) on both the test set and the training set.

Table 1 Numerical outcome of microgird profits.

Methods	Methods				
	Swin-T (Yang et al 2022)	CNN (Yang et al 2022)	DNN (Yang et al 2022)	RF (Yang et al 2022)	SVM (Yang et al 2022)
Accuracy (%)	99.55	96.83	96.64	93.94	88.11
Precision (%)	99.1	94.7	94.32	99.27	90.68
Recall (%)	100	98.92	98.92	87.4	85.09
F1-Score (%)	99.55	96.76	96.57	92.96	87.8

Source: https://www.mdpi.com/2072-4292/14/24/6360

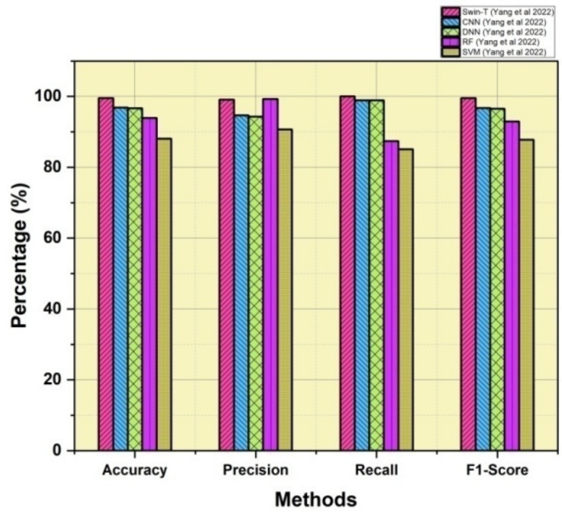

Figure 2 Model Comparison and Validation.
Source: https://www.mdpi.com/2072-4292/14/24/6360

The research counted the particular proportions of the various susceptibility groups and compared the classifications across several types. To verify these results even further, a statistical analysis of the frequency with which floods occur in different vulnerable regions was conducted. Refer to Table 2 and Figure 3 for further information.

Table 2 Different Vulnerable Regions.

Vulnerable Regions	Percentage of susceptibility class		
	Warming Type	All Types	Mixed Type
Low	40.95	30.08	45.95
Very low	86.35	87.77	72.49
High	40.6	20.21	30.56
Very high	20.85	50.12	30.6
Moderate	40.32	30.44	50.84

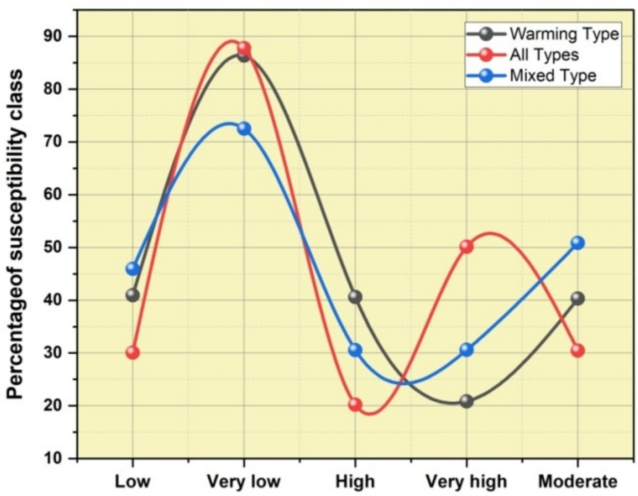

Figure 3 Statistical distribution of vulnerability to various floods.

For each modeled flood event, the land use map of the floodplains was intersected with the flood area polygon to generate vulnerability maps for the affected regions. Table 3 and Figure 4 provide a synopsis of the land use area affected by the predicted flood.

Table 3 Flood Vulnerability Analysis.

Vulnerability Analysis	Area (hectares)			
	2 Years	10 Years	50 Years	100 Years
Cultivation	41.93	45.043	47.488	48.478
Sand Area	108.93	111.23	112.852	113.4001
River	26.077	26.525	26.852	26.9721
Orchard	0.007	0.04	0.066	0.0801
Cutting Area	0.039	0.043	0.045	0.0451
Bush	0	0	0	0.0001
Barren Land	0.0096	0.096	0.096	0.096
Forest	52.434	57.4	59.363	60.457

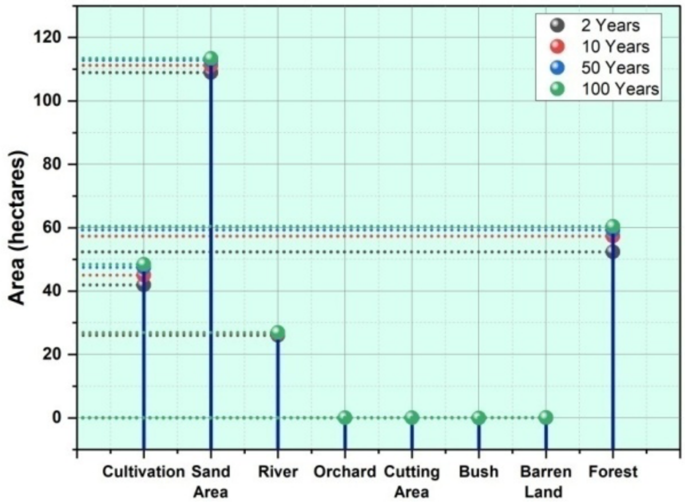

Figure 4 Classification of Flood Risk Based on Return Period.

3. Discussion and Conclusion

One model can be used to evaluate many aspects of vulnerability simultaneously. The incapacity of any given group or community to weather the effects of a given incident is correlated with that group's or community's social fragility (Cianconi et al 2020). Low-income people have been seen as more at risk from natural disasters like floods. To create maps of the most at-risk areas due to natural disasters, they synthesized indicators based on their relative importance. The Scopus database and other scientific and scholarly literature include more studies on floods and associated phenomena. Previous studies focused on flash floods, coastal floods and reverie floods because of global climate change and unpredictability (Lundberg et al 2021). As the population concentrates in cities throughout the globe, studies of urban flood risk have received more attention.

This research attempted to examine many facets, strategies and approaches to vulnerability assessment of floods. To produce a thorough and consistent study of the available methods, we evaluated over 200 works by referenced researchers. Graphical representations of methodologies, databases and records of flood-related research that are useful for determining the direction of flood vulnerability assessment have been provided. Recent models used for assessing flood susceptibility were analyzed with the overall methodological framework that has developed throughout time. The most common flood risk indicators and approaches to evaluating such vulnerability were analyzed. By broadening the idea of flood vulnerability, we can reduce the gaps between methodologies and solutions. To conduct a thorough study of the risk of flooding, it is recommended to use a multifaceted strategy, algorithms based on artificial intelligence, excellent quality satellite data, a hydraulic model and an appropriate choice of flood conditioning factors. The future of vulnerability assessment lies in the use of high-resolution satellite imagery, location-specific metrics, complex models and multidimensional approaches.

Ethical Considerations

Not Applicable.

Conflict of Interest

The authors declare no conflict of interest.

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References

Azareh A, RafieiSardooi E, Choubin B, Barkhori S, Shahdadi A, Adamowski J & Shamshirband S (2021) Incorporating multi-criteria decision-making and fuzzy-value functions for flood susceptibility assessment. *Geocarto International*, 36(20), 2345-2365. DOI: 10.1080/10106049.2019.1695958.

Brennan M, Rondon-Sulbaran J, Sabogal-Paz LP, Fernandez-Ibañez P & Galdos-Balzategui A (2021) Conceptualising global water challenges: A transdisciplinary approach for understanding different discourses in sustainable development. *Journal of Environmental Management*, 298, 113361. DOI: 10.1016/j.jenvman.2021.113361.

Chan SW, Abid SK, Sulaiman N, Nazir U & Azam K (2022) A systematic review of the flood vulnerability using geographic information system. *Heliyon* DOI: 10.1016/j.heliyon.2022.e09075.

Chang SE, Yip JZ & Tse W (2019) Effects of urban development on future multi-hazard risk: The case of Vancouver, Canada. Natural Hazards 98:251-65. DOI: 10.1007/s11069-018-3510-x.

Chaulagain D, Rimal PR, Ngando SN, Nsafon BE, Suh D & Huh JS (2023) Flood susceptibility mapping of Kathmandu metropolitan city using GIS-based multi-criteria decision analysis. *Ecological Indicator*, 154, 110653. DOI: 10.1016/j.ecolind.2023.110653.

Cianconi P, Betrò S & Janiri L (2020). The impact of climate change on mental health: a systematic descriptive review. *Frontiers in psychiatry*, 11, 74. DOI: 10.3389/fpsyt.2020.00074

Deria A, Ghannad P & Lee YC (2020) Evaluating implications of flood vulnerability factors with respect to income levels for building long-term disaster resilience of low-income communities. *International Journal of Disaster Risk Reduction*, 48, 101608. DOI: 10.1016/j.ijdrr.2020.101608.

Djoumessi Tiague B (2023) Floods, Agricultural Production, and Household Welfare: Evidence from Tanzania. *Environmental and Resource Economics*, 85(2), 341-84. DOI: 10.1007/s10640-023-00769-3.

Faeghi S & Roche S (2019) Environmental Configurations: When the River ZayandehRud Stopped Crossing Isfahan. *Anthropology of the Middle East,* 14(2), 29-41. DOI: 10.3167/ame.2019.140203.

Garrote J, Peña E & Díez-Herrero A (2021) Probabilistic flood hazard maps from Monte Carlo derived peak flow values—An application to flood risk management in Zamora city (Spain). *Applied Sciences*, 11(14), 6629. DOI: 10.1016/j.ijdrr.2022.103011.

Gaynor TS & Wilson ME (2020) Social vulnerability and equity: The disproportionate impact of COVID-19. *Public administration review*, 80(5), 832-8. DOI: 10.1332/239788221X16216113385146.

Grimaccia E & Naccarato A (2019) Food insecurity individual experience: A comparison of economic and social characteristics of the most vulnerable groups in the world. *Social indicators research*, 143, 391-410. DOI: 10.1007/s11205-018-1975-3.

Guo X & Kapucu N (2020) Assessing social vulnerability to earthquake disaster using rough analytic hierarchy process method: A case study of Hanzhong City, China. *Safety science*, 125, 104625. DOI: 10.1016/j.ssci.2020.104625.

Hussain M, Tayyab M, Zhang J, Shah AA, Ullah K, Mehmood U & Al-Shaibah B (2021) GIS-based multi-criteria approach for flood vulnerability assessment and mapping in district Shangla: Khyber Pakhtunkhwa, Pakistan. *Sustainability,* 13(6), 3126. DOI: 10.3390/su13063126.

Islam AR, Talukdar S, Mahato S, Kundu S, Eibek KU, Pham QB, Kuriqi A & Linh NT (2021). Flood susceptibility modeling using advanced ensemble machine learning models. *Geoscience Frontiers*, 12(3), 101075. DOI: 10.1016/j.gsf.2020.09.006.

Islam MM & Ahamed T (2023) Development of a near-infrared band derived water indices algorithm for rapid flash flood inundation mapping from sentinel-2 remote sensing datasets. *Asia-Pacific Journal of Regional Science,* 1-26. DOI: 10.1007/s41685-023-00288-5.

Jozaei J, Chuang WC, Allen CR & Garmestani A (2022) Social vulnerability, social-ecological resilience and coastal governance. *Global Sustainability,* 5, e12. DOI: 10.1017/sus.2022.10.

Khadka N, Chen X, Nie Y, Thakuri S, Zheng G & Zhang G (2021) Evaluation of Glacial Lake Outburst Flood susceptibility using multi-criteria assessment framework in Mahalangur Himalaya. *Frontiers in Earth Science,* 8, 601288. DOI: 10.3389/feart.2020.601288.

Kumar M, Kalra N, Singh H, Sharma S, Rawat PS, Singh RK, Gupta AK, Kumar P & Ravindranath NH (2021) Indicator-based vulnerability assessment of forest ecosystem in the Indian Western Himalayas: An analytical hierarchy process integrated approach. *Ecological Indicators*, 125, 107568. DOI: 10.1016/j.ecolind.2021.107568.

Langill JC & Abizaid C (2022) What is a bad flood? Local perspectives of extreme floods in the Peruvian Amazon. *Ambio*, 49(8), 1423-36. DOI: 10.1007/s13280-019-01278-8.

Lechowska E (2022) Approaches in research on flood risk perception and their importance in flood risk management: a review. *Natural Hazards*, 111(3), 2343-78. DOI: 10.1007/s11069-021-05140-7.

Li S, Wang Z, Lai C & Lin G (2020). Quantitative assessment of the relative impacts of climate change and human activity on flood susceptibility based on a cloud model. *Journal of Hydrology*, 588, 125051. DOI: 10.1016/j.jhydrol.2020.125051.

Lorie M, Neumann JE, Sarofim MC, Jones R, Horton RM, Kopp RE, Fant C, Wobus C, Martinich J, O'Grady M & Gentile LE (2020) Modeling coastal flood risk and adaptation response under future climate conditions. *Climate risk management*, 29, 100233. DOI: https://doi.org/10.1016/j.crm.2020.100233.

Lundberg A, Vital AV & Das S. (2021) Tropical imaginaries and climate crisis: embracing relational climate discourses. Etropic: electronic *journal of studies in the tropics*, 20, 1-31. DOI:10.25120/etropic.20.2.2021.3803

Mahato S, Pal S, Talukdar S, Saha TK & Mandal P (2021) Field based index of flood vulnerability (IFV) A new validation technique for flood susceptible models. *Geoscience Frontiers*, 12(5), 101175. DOI: 10.1016/j.gsf.2020.09.006.

Manfreda S & Samela C (2019) A digital elevation model based method for a rapid estimation of flood inundation depth. *Journal of Flood Risk Management*, 12, e12541. DOI: 10.1111/jfr3.12541.

McEntire DA (2021) Disaster response and recovery: strategies and tactics for resilience. *John Wiley & Sons* ; DOI: 10.1007/s12517-022-07324-9.

Mendelsohn R, Rajaoberison A & Yoo J (2020) A coastal resilience analysis of a heterogeneous landscape. *Journal of Environmental Protection,* 11(6), 441-56. DOI: 10.1080/08920753.2022.2037387.

Mind'je R, Li L, Amanambu AC, Nahayo L, Nsengiyumva JB, Gasirabo A & Mindje M (2021). Flood susceptibility modeling and hazard perception in Rwanda. International journal of disaster risk reduction 38:101211. DOI: 10.1016/j.ijdrr.2019.101211.

Ou M, Zhong Y, Ma H, Wang W & Bi M (2022) Impacts of policy-driven transformation in the livelihoods of fishermen on agricultural landscape patterns: A case study of a fishing village, island of Poyang Lake. *Land,* 11(8), 1236. DOI: 10.3390/land11081236

Paprotny D, Kreibich H, Morales-Nápoles O, Wagenaar D, Castellarin A, Carisi F, Bertin X, Merz B & Schröter K (2021) A probabilistic approach to estimating residential losses from different flood types. *Natural Hazards*, 105, 2569-601. DOI: 10.1007/s11069-020-04413-x.

Paulik R, Wild A, Zorn C & Wotherspoon L (2022) Residential building flood damage: Insights on processes and implications for risk assessments. *Journal of Flood Risk Management*, 15(4), e12832. DOI: 10.1111/jfr3.12832.

Rafiei-Sardooi E, Azareh A, Choubin B, Mosavi AH & Clague JJ (2021) Evaluating urban flood risk using hybrid method of TOPSIS and machine learning. *International Journal of Disaster Risk Reduction*, 66, 102614. DOI: 10.1016/j.ijdrr.2021.102614.

Rehman S, Sahana M, Hong H, Sajjad H & Ahmed BB (2019) A systematic review on approaches and methods used for flood vulnerability assessment: Framework for future research. *Natural Hazards,* 96, 975-98. DOI: 10.1007/s11069-018-03567-z.

Roy P, Pal SC, Chakrabortty R, Chowdhuri I, Malik S & Das B (2020) Threats of climate and land use change on future flood susceptibility. *Journal of Cleaner Production*, 272, 122757. DOI: 10.1016/j.jclepro.2020.122757.

Roy S, Bose A & Chowdhury IR (2021) Flood risk assessment using geospatial data and multi-criteria decision approach: a study from historically active flood-prone region of Himalayan foothill, India. *Arabian Journal of Geosciences*, 14(11), 999. DOI: 10.1007/s12517-021-07324-8.

Saha A, Pal SC, Arabameri A, Blaschke T, Panahi S, Chowdhuri I, Chakrabortty R, Costache R & Arora A (2021) Flood susceptibility assessment using novel ensemble of hyperpipes and support vector regression algorithms. *Water,* 13(2), 241. DOI: 10.3390/w13020241.

Taghinezhad A, Friedland CJ & Rohli RV (2021) Benefit-cost analysis of flood-mitigated residential buildings in Louisiana. *Housing and Society*, 48(2), 185-202. DOI: 10.1080/08882746.2020.1796120.

Talukdar S, Ghose B, Shahfahad, Salam R, Mahato S, Pham QB, Linh NT, Costache R & Avand M (2020) Flood susceptibility modeling in Teesta River basin, Bangladesh using novel ensembles of bagging algorithms. Stochastic *Environmental Research and Risk Assessment*, 34, 2277-300. DOI: 10.1007/s00477-020-01862-5.

van der Geest K & Warner K (2019) Loss and damage in the IPCC Fifth Assessment Report (Working Group II): a text-mining analysis. *Climate Policy*, 20(6), 729-42. DOI: 10.1080/14693062.2019.1704678.

Yang R, Zheng G, Hu P, Liu Y, Xu W & Bao A (2022) Snowmelt Flood Susceptibility Assessment in Kunlun Mountains Based on the Swin Transformer Deep Learning Method. *Remote Sensing*, 14(24), 6360. DOI: 10.3390/rs14246360.

Yaseen A, Lu J & Chen X (2022) Flood susceptibility mapping in an arid region of Pakistan through ensemble machine learning model. Stochastic *Environmental Research and Risk Assessment*, 36(10), 3041-61. DOI: 10.1007/s00477-022-02179-1.

Zeng Z, Lan J, Hamidi AR & Zou S (2020) Integrating Internet media into urban flooding susceptibility assessment A case study in China. *Cities,* 101, 102697.DOI: 10.1016/j.cities.2020.102697.