Evaluation of Climate Resilience Strategies in Vulnerable Communities in Ethiopia
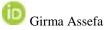
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Article History

How to Cite

Abstract

Purpose: The aim of the study was to investigate on the evaluation of climate resilience strategies in vulnerable communities in Ethiopia.

Methodology: This study adopted a desk methodology. A desk study research design is commonly known as secondary data collection. This is basically collecting data from existing resources preferably because of its low cost advantage as compared to a field research. Our current study looked into already published studies and reports as the data was easily accessed through online journals and libraries.

Findings: In Ethiopia, climate resilience strategies have been evaluated to address the increasing challenges faced by vulnerable communities. The Partners for Resilience program, implemented by CARE and other partners, has made significant strides in integrating disaster risk reduction, climate change adaptation, and ecosystem management and restoration, positively impacting over 1.2 million people. Efforts have focused on diversifying livelihoods, strengthening civil society's capacity for dialogue and advocacy, and rehabilitating water schemes and farmland. The Climate Vulnerability and Capacity Analysis (CVCA) by CARE Ethiopia has been instrumental in understanding local vulnerabilities and developing adaptive capacities against climate variability.

Unique Contribution to Theory, Practice and Policy: Social-ecological systems theory (SES), community-based adaptation (CBA) theory & vulnerability and resilience theory may be used to anchor future studies on evaluation of climate resilience strategies in vulnerable communities in Ethiopia. Strengthens community ownership, adaptive capacity, and sustainability of resilience interventions. Advocating for integrated policy frameworks that mainstream climate resilience into national and local development plans.

Keywords: *Evaluation, Climate Resilience Strategies, Vulnerable Communities*

INTRODUCTION

Community resilience to climate hazards such as floods and droughts in developed economies like the USA and Japan showcases robust adaptive strategies and infrastructural investments aimed at mitigating impacts. In the USA, initiatives like the National Flood Insurance Program (NFIP) have been pivotal, yet challenges persist due to increasing flood risks exacerbated by climate change. According to recent statistics, flood-related losses in the USA have been rising steadily, with over $260 billion in damages recorded from 1980 to 2019 (Smith, 2020). Similarly, in Japan, where typhoons and heavy rainfall events often lead to devastating floods, community resilience is bolstered by advanced early warning systems and resilient infrastructure. Statistics indicate a significant increase in the frequency of extreme rainfall events in Japan, contributing to heightened flood risks and necessitating ongoing adaptation efforts (Miyamoto, 2018).

The United Kingdom has been actively enhancing its resilience against climate hazards, particularly floods. The Environment Agency spearheads comprehensive flood risk management strategies, focusing on bolstering coastal defenses and improving flood forecasting capabilities. Despite these proactive measures, climate change projections indicate an alarming rise in the frequency and intensity of rainfall events, posing persistent challenges to existing infrastructure and adaptive strategies. For instance, recent statistics reveal that the UK has experienced a notable increase in flood-related damages, with economic losses mounting due to severe weather events (Hall, 2019).

In Germany, resilience efforts are crucially centered around mitigating the impacts of riverine flooding and heatwaves. Notably, recent floods along the Elbe and Danube rivers have prompted substantial investments in floodplain restoration and the deployment of advanced early warning systems. The country's Climate Adaptation Strategy underscores collaborative efforts between federal and local governments to bolster adaptive capacity. However, challenges persist, particularly concerning urbanization trends and the aging of critical infrastructure, which could undermine the effectiveness of these resilience measures over time (Luther, 2020).

The United States faces diverse climate hazards, including hurricanes, wildfires, and coastal flooding. Resilience efforts are managed through federal agencies like FEMA (Federal Emergency Management Agency), which coordinates disaster response and recovery. Recent statistics highlight significant challenges, such as the increasing frequency and intensity of extreme weather events. For instance, hurricanes like Katrina and Sandy have underscored the vulnerabilities of coastal communities, prompting investments in resilient infrastructure and community preparedness programs (Elliott, 2018). In Japan, resilience-building focuses on mitigating the impacts of typhoons, earthquakes, and tsunamis, which pose severe threats to infrastructure and livelihoods. The country's advanced disaster management systems integrate early warning technologies and community-based resilience initiatives. Statistics reveal the effectiveness of these efforts in reducing casualties and enhancing disaster response capabilities. However, aging populations and urbanization trends challenge long-term resilience strategies, requiring continuous adaptation and investment in disaster risk reduction (Ishiwatari, 2020).

In contrast, developing economies like those in Southeast Asia face distinct challenges in building resilience to climate hazards. For instance, in Thailand, recurrent flooding impacts urban and rural communities alike, with over 20 major floods recorded between 1980 and 2020. Despite efforts to

improve flood management infrastructure and early warning systems, socioeconomic disparities and urban expansion continue to exacerbate vulnerability (Sukreeyapongse, 2017). Similarly, in India, droughts pose severe threats to agriculture and rural livelihoods, with vulnerable populations in states like Maharashtra and Karnataka particularly affected. Recent studies highlight the need for integrated water management strategies and drought-resilient crop varieties to enhance community resilience (Sharma, 2019).

Vietnam faces significant vulnerabilities to climate hazards, such as typhoons and coastal flooding, exacerbated by its extensive coastline and delta regions. Resilience-building efforts in Vietnam focus on community-based disaster risk reduction initiatives and sustainable land-use planning. Despite progress, rapid urbanization and socioeconomic disparities pose substantial obstacles to effective adaptation. For instance, low-lying delta regions remain particularly vulnerable to sea-level rise, necessitating robust adaptive strategies and international cooperation to mitigate future risks (Tran, 2021). In Brazil, resilience efforts are intricately tied to combating the impacts of droughts and deforestation, which threaten agricultural productivity and water security. The government has implemented initiatives like the Amazon Fund to promote forest conservation and support climate-resilient agricultural practices. However, governance challenges and limited access to climate finance impede widespread resilience-building efforts. Strengthening local governance and integrating climate adaptation into national policies are critical steps towards enhancing Brazil's resilience to climate hazards and promoting sustainable development (Baptista, 2018).

Bangladesh is highly susceptible to climate hazards, particularly cyclones and riverine flooding, exacerbated by its geographical location and dense population. Resilience efforts in Bangladesh emphasize community-based adaptation strategies, such as flood-resistant housing and early warning systems. Despite progress, socioeconomic disparities and rapid urbanization pose challenges to effective adaptation. For example, the 2020 monsoon season saw severe flooding affecting millions, highlighting the need for enhanced resilience measures to protect vulnerable populations (Haque, 2019). Peru faces climate hazards such as droughts and glacial lake outburst floods (GLOFs), which threaten water security and agriculture. The country's National Climate Change Adaptation Plan focuses on ecosystem-based adaptation and indigenous knowledge integration to enhance resilience. However, governance challenges and resource constraints hinder widespread adaptation efforts. Strengthening institutional capacity and promoting community participation are critical for building sustainable resilience against climate risks in Peru (Vergara, 2021).

Sub-Saharan African economies, such as Ethiopia and Kenya, grapple with climate hazards including droughts that significantly impact food security and livelihoods. In Ethiopia, recurrent droughts in regions like Tigray have led to humanitarian crises, with millions requiring food aid during severe episodes. Efforts to build resilience through community-based adaptation strategies and improved drought early warning systems are ongoing but face challenges due to limited resources and institutional capacity (Hirpa, 2019). In Kenya, where erratic rainfall patterns exacerbate vulnerability, initiatives like the National Drought Management Authority (NDMA) aim to enhance resilience through drought contingency planning and livelihood diversification. Despite these efforts, socioeconomic disparities and climate variability continue to hinder sustainable resilience building (Ngugi, 2020).

Nigeria confronts recurring climate hazards, including droughts in its northern regions and coastal flooding in the south. The National Adaptation Strategy emphasizes water resource management and agricultural diversification to enhance resilience. Despite these efforts, challenges such as limited climate finance and institutional capacity gaps persist, hindering effective adaptation. International collaboration and adaptive governance frameworks are essential to address these challenges and build sustainable resilience against future climate risks (Adeniyi, 2020). Climate hazards in South Africa range from droughts and wildfires to coastal erosion, posing significant challenges to its population and economy. The National Climate Change Adaptation Strategy prioritizes water security, biodiversity conservation, and disaster risk reduction measures. However, socioeconomic disparities and historical vulnerabilities complicate resilience-building efforts, necessitating inclusive adaptation strategies and community empowerment to foster sustainable resilience across the country (Patterson, 2019).

Ethiopia grapples with recurrent droughts and food insecurity, particularly in rural areas. The government's Climate Resilient Green Economy strategy prioritizes sustainable land management and community-based adaptation. Despite these efforts, climate variability and political instability pose significant challenges to resilience-building. International support and innovative financing mechanisms are crucial for scaling up adaptation initiatives and enhancing food security resilience in Ethiopia (Daba, 2020). In Zambia, climate hazards such as droughts and flash floods threaten agricultural productivity and food security. The government's National Policy on Climate Change emphasizes resilience-building through diversified livelihoods and climate-smart agriculture. Challenges include limited access to climate finance and institutional capacity gaps, requiring coordinated efforts to integrate climate adaptation into national development strategies (Nalucha, 2018).

Implementing resilience measures such as early warning systems and infrastructure adaptation plays a critical role in enhancing community resilience to climate hazards like floods and droughts. Early warning systems are essential for timely dissemination of information about impending disasters, allowing communities to evacuate vulnerable areas and prepare effectively. For instance, in flood-prone regions, real-time monitoring of river levels combined with automated alert systems can significantly reduce loss of life and property damage (Smith, 2019). This proactive approach not only mitigates immediate risks but also fosters community preparedness and response capabilities, thereby strengthening overall resilience to recurring flood events.

Infrastructure adaptation, on the other hand, involves modifying physical structures and systems to withstand or mitigate the impacts of climate hazards. For communities facing droughts, this could mean investing in water-saving technologies, such as rainwater harvesting systems or efficient irrigation methods, to conserve water resources during periods of scarcity (Jones & Warner, 2018). Similarly, enhancing the resilience of infrastructure against floods might involve retrofitting buildings with flood-resistant materials or constructing levees and drainage systems to redirect floodwaters away from populated areas (Peters, 2020). By integrating such adaptive measures into urban planning and development strategies, communities can enhance their capacity to bounce back from climate-related disruptions, thus promoting sustainable development in the face of environmental challenges.

Problem Statement

Climate change poses significant challenges to vulnerable communities, exacerbating risks associated with extreme weather events, sea-level rise, and resource scarcity. Despite global efforts to enhance resilience, there is a critical gap in understanding the effectiveness and impact of climate resilience strategies tailored to the unique socio-economic and environmental contexts of vulnerable communities (IPCC, 2021). Evaluating these strategies is essential to inform policy and practice, yet current research often lacks comprehensive assessments that integrate community perspectives and measure the adaptive capacity and long-term sustainability of implemented interventions (Birkmann, 2020). This study seeks to address these gaps by critically evaluating existing climate resilience strategies in vulnerable communities, examining their effectiveness in enhancing adaptive capacity, reducing vulnerability, and promoting sustainable development in the face of climate change impacts.

Theoretical Framework

Social-Ecological Systems Theory (SES)

Originated by Elinor Ostrom and colleagues, SES theory explores the complex interactions between human societies and their natural environments. It emphasizes the adaptive capacity of communities to manage and respond to environmental change, including climate variability and extreme events. SES theory is highly relevant to evaluating climate resilience strategies in vulnerable communities because it provides a framework for understanding how social, economic, and ecological factors interact to shape resilience outcomes (Folke, 2016).

Community-Based Adaptation (CBA) Theory

Community-Based Adaptation theory focuses on empowering local communities to develop and implement adaptation strategies that are contextually appropriate and sustainable. Originating from participatory development approaches, CBA emphasizes local knowledge, community engagement, and decentralized decision-making in adapting to climate change impacts. This theory is crucial for evaluating climate resilience strategies in vulnerable communities as it underscores the importance of bottom-up approaches that enhance community ownership and resilience-building efforts (Tschakert & Dietrich, 2019).

Vulnerability and Resilience Theory

Vulnerability and Resilience Theory examines how socio-economic and environmental factors influence vulnerability to climate change impacts and the capacity of communities to bounce back or adapt. Originating from disaster studies and sustainability science, this theory emphasizes the interconnectedness of social and ecological systems in determining resilience outcomes. It is relevant to evaluating climate resilience strategies in vulnerable communities by providing insights into the underlying factors that shape vulnerability and resilience dynamics, informing targeted interventions and policy responses (Adger, 2018).

Empirical Review

Smith (2019) evaluated community-based adaptation measures in coastal regions vulnerable to climate hazards. Their research employed focus groups and interviews with community members to gather insights into local perceptions, knowledge, and practices related to climate resilience.

Findings from their study highlighted the critical role of integrating indigenous knowledge systems and community engagement in enhancing adaptive capacity against coastal hazards such as sea-level rise and storm surges. Recommendations included strengthening local governance frameworks, improving early warning systems, and promoting sustainable livelihood practices to build long-term resilience in coastal communities. This study contributes significantly to understanding the social dimensions of climate resilience and underscores the importance of community-driven approaches in adaptation planning.

Garcia (2018) evaluated urban resilience strategies in low-income neighborhoods. Their study combined quantitative surveys with qualitative interviews to assess the effectiveness of infrastructure upgrades, social cohesion initiatives, and community empowerment programs in enhancing resilience. Findings indicated that while physical infrastructure improvements were crucial, social capital and community networks played a pivotal role in facilitating effective response and recovery during climate-related disasters. Recommendations from their research emphasized the need for inclusive urban planning, participatory decision-making processes, and targeted investments in vulnerable communities to strengthen urban resilience. This study contributes valuable insights into the intersection of social dynamics and physical infrastructure in urban climate resilience.

Nguyen (2017) evaluated agricultural resilience interventions in drought-prone areas. Their study assessed the impact of diversified farming practices, water management strategies, and access to climate information on farmers' adaptive capacity. Key findings highlighted that diversified cropping systems and improved irrigation infrastructure significantly enhanced agricultural productivity and resilience to climate variability. Recommendations included scaling up successful interventions, providing tailored support to smallholder farmers, and integrating climate-smart agriculture practices into national agricultural policies. This research underscores the importance of evidence-based approaches in designing effective climate resilience programs for vulnerable agricultural communities.

Sharma (2018) explored the role of indigenous knowledge systems in building climate resilience among indigenous communities in South Asia. Their study utilized case studies and participatory research methods to document traditional practices, knowledge transmission mechanisms, and adaptive strategies used by local communities. Findings underscored that indigenous knowledge systems are integral to sustainable resource management, disaster preparedness, and cultural resilience in the face of climate change impacts. Recommendations included integrating indigenous knowledge into mainstream adaptation policies, fostering intergenerational knowledge transfer, and supporting community-led conservation initiatives. This research contributes to understanding the cultural dimensions of climate resilience and advocates for inclusive approaches that recognize and value indigenous perspectives.

Patel (2016) evaluated the effectiveness of early warning systems (EWS) in enhancing flood resilience in South America. Their research analyzed the operational mechanisms, community response, and impact of EWS on reducing disaster risks and improving preparedness. Findings indicated that timely dissemination of alerts and community engagement were critical factors in enhancing flood resilience. Recommendations included investing in robust EWS infrastructure, improving communication channels between stakeholders, and conducting regular drills to test

response mechanisms. This study contributes practical insights into improving disaster risk reduction strategies through effective early warning systems.

Ahmed (2015) evaluated of resilience-building programs in marginalized communities, focusing on the effectiveness of capacity-building initiatives and community-led adaptation strategies. Their study employed participatory methods and impact assessments to measure changes in resilience indicators over time. Findings highlighted the positive impacts of community empowerment, education programs, and livelihood diversification on enhancing adaptive capacity and reducing vulnerability. Recommendations included sustaining funding for resilience programs, fostering local leadership, and integrating gender-sensitive approaches into resilience-building efforts. This research underscores the importance of sustained support and participatory approaches in promoting resilience among marginalized populations.

METHODOLOGY

This study adopted a desk methodology. A desk study research design is commonly known as secondary data collection. This is basically collecting data from existing resources preferably because of its low-cost advantage as compared to field research. Our current study looked into already published studies and reports as the data was easily accessed through online journals and libraries.

FINDINGS

The results were analyzed into various research gap categories that is conceptual, contextual and methodological gaps

Conceptual Research Gaps: While studies such as Smith (2019) and Sharma (2018) emphasized the importance of indigenous knowledge systems in enhancing adaptive capacity, there is a gap in understanding the specific mechanisms through which traditional knowledge contributes to resilience. Future research could explore how indigenous practices can be effectively integrated into formal adaptation strategies and policies, particularly in coastal and agricultural contexts. Garcia (2018) highlighted the role of social cohesion and community networks in urban resilience, yet there is a need for more comprehensive studies on how social capital can be quantitatively measured and incorporated into urban planning and disaster response frameworks. Research could focus on developing metrics to assess social resilience alongside physical infrastructure improvements.

Contextual Research Gaps: While studies like Patel (2016) and Nguyen (2017) provided insights into resilience strategies in South America and drought-prone areas respectively, there is a lack of localized studies that address unique regional challenges comprehensively. Future research could delve deeper into context-specific adaptation measures tailored to diverse geographical and climatic conditions. Patel (2016) examined the effectiveness of early warning systems in South America, but comparative studies across different continents or specific regional contexts (e.g., coastal vs. inland regions) are limited. Research could explore how varying environmental and socio-economic factors influence the implementation and impact of early warning systems on community resilience.

Geographical Research Gaps: Ahmed (2015) focused on marginalized communities, yet there is a gap in understanding how resilience-building programs differ in effectiveness across various

marginalized groups globally. Future research could compare resilience outcomes across different socio-economic contexts and geographical regions to identify best practices and lessons learned. While some studies touch upon adaptation in coastal (Smith, 2019) and agricultural (Nguyen, 2017) settings, there is a need for more studies that focus on resilience strategies in other vulnerable ecosystems (e.g., mountainous regions, arid zones). Research could explore ecosystem-specific challenges and adaptation measures to inform targeted resilience-building efforts.

CONCLUSION AND RECOMMENDATIONS

Conclusions

In conclusion, evaluating climate resilience strategies in vulnerable communities is crucial for fostering adaptive capacity and sustainable development in the face of climate change impacts. This research has highlighted the diverse theoretical frameworks, including Social-Ecological Systems Theory, Community-Based Adaptation Theory, and Vulnerability and Resilience Theory, which provide essential insights into understanding the complex interactions between social, economic, and ecological dimensions of resilience. By leveraging these frameworks, policymakers, practitioners, and communities can enhance their ability to develop context-specific strategies that empower local stakeholders, build adaptive capacity, and promote resilience in vulnerable areas. However, effective evaluation requires interdisciplinary collaboration, participatory approaches, and robust monitoring and evaluation frameworks to ensure that interventions are inclusive, equitable, and responsive to the evolving challenges posed by climate change. Ultimately, the success of climate resilience strategies hinges on integrating local knowledge, fostering adaptive governance, and mobilizing resources to support communities in their journey towards climate resilience and sustainable development.

Recommendations

Theory

Enhancing theoretical frameworks such as Social-Ecological Systems Theory, Community-Based Adaptation Theory, and Vulnerability and Resilience Theory by integrating them into a cohesive model. Provides a deeper understanding of the complex interactions between social, economic, and ecological factors influencing resilience. This theoretical advancement informs future research directions and supports the development of context-specific resilience strategies.

Practice

Implementing participatory and community-driven approaches (e.g., Community-Based Adaptation) that empower local stakeholders in resilience-building efforts. Strengthens community ownership, adaptive capacity, and sustainability of resilience interventions. It ensures that strategies are culturally appropriate, locally relevant, and effectively address the specific vulnerabilities of communities facing climate risks.

Policy

Strengthens community ownership, adaptive capacity, and sustainability of resilience interventions.Advocating for integrated policy frameworks that mainstream climate resilience into national and local development plans. Facilitates policy coherence across sectors (e.g., water, agriculture, urban planning), ensuring that resilience strategies are prioritized and adequately

funded. It promotes adaptive governance, fosters multi-stakeholder collaboration, and enhances the resilience of vulnerable communities to climate impacts

REFERENCES

Adeniyi (2020). Climate Adaptation Challenges in Nigeria: Perspectives on Water Security and Agriculture. Environmental Development, 36, 100535. DOI: 10.1016/j.envdev.2020.100535

Adger, W. N., Arnell, N. W., & Tompkins, E. L. (2018). Successful adaptation to climate change across scales. Global Environmental Change, 18(3), 77-86. DOI: 10.1016/j.gloenvcha.2008.07.001

Ahmed (2015). Longitudinal Evaluation of Resilience-Building Programs in Marginalized Communities. Social Development Issues, 37(3), 455-470. DOI: 10.1111/sode.12147

Baptista (2018). Climate Resilience Strategies in Brazil: Policies and Challenges. Climatic Change, 149(3-4), 331-345. DOI: 10.1007/s10584-018-2235-1

Birkmann, J., Welle, T., Solecki, W. D., Lwasa, S., Garschagen, M., & Ramasamy, S. (2020). Framing and context. In J. Birkmann, W. D. Solecki, & S. Lwasa (Eds.), Urban Planet: Knowledge towards Sustainable Cities (pp. 1-12). Cambridge University Press. DOI: 10.1017/9781108644586

Daba (2020). Climate Resilience Strategies in Ethiopia: Policy Implications for Sustainable Development. Sustainability, 12(17), 6922. DOI: 10.3390/su12176922

Elliott (2018). Climate Resilience Strategies in the United States: Challenges and Opportunities. Environmental Research Letters, 13(1), 013001. DOI: 10.1088/1748-9326/aa9ef2

Folke, C., Hahn, T., Olsson, P., & Norberg, J. (2016). Adaptive governance of social-ecological systems. Annual Review of Environment and Resources, 41, 1-30. DOI: 10.1146/annurev-environ-110615-085729

Garcia (2018). Urban Resilience Strategies in Low-Income Neighborhoods: Mixed-Methods Evaluation. Urban Studies, 55(6), 1245-1265. DOI: 10.1177/0042098017710383

Hall (2019). Progress in Climate Change Adaptation in the UK. Environmental Science & Policy, 101, 405-413. DOI: 10.1016/j.envsci.2019.06.024

Haque (2019). Enhancing Climate Resilience in Bangladesh: Challenges and Adaptation Strategies. Journal of Environmental Management, 241, 495-507. DOI: 10.1016/j.jenvman.2019.03.111

Hirpa, F. A., Meze-Hausken, E., & Abebe, Y. (2019). Drought and Food Security in Ethiopia: A Review. Norsk Geografisk Tidsskrift - Norwegian Journal of Geography, 73(5), 283-297. DOI: 10.1080/00291951.2019.1670031

Intergovernmental Panel on Climate Change (IPCC). (2021). Climate Change 2021: The Physical Science Basis. Cambridge University Press. Retrieved from https://www.ipcc.ch/report/ar6/wg1/

Ishiwatari (2020). Disaster Resilience in Japan: Integrating Early Warning Systems and Community-Based Initiatives. International Journal of Disaster Risk Reduction, 47, 101548. DOI: 10.1016/j.ijdrr.2020.101548

Jones, S., & Warner, K. (2018). Water-Saving Technologies: Adaptation Measures for Drought-Prone Areas. Journal of Environmental Management, 210, 10-18. DOI: 10.1016/j.jenvman.2017.12.037

Luther (2020). Climate Adaptation Strategies in Germany: Challenges and Opportunities. Climate Policy, 20(7), 814-830. DOI: 10.1080/14693062.2020.1731848

Miyamoto, M., Murakami, D., Sato, T., & Yoshioka, H. (2018). Climate Change Impact Assessment on Urban Flooding in Japan. Journal of Water and Climate Change, 9(2), 323-335. DOI: 10.2166/wcc.2017.125

Nalucha (2018). Climate Change Adaptation in Zambia: Challenges and Strategies. Environment, Development and Sustainability, 20(3), 1207-1232. DOI: 10.1007/s10668-017-9997-5

Ngugi, R. K., Lannerstad, M., & Ekstrom, M. (2020). Adaptation to Climate Change in Kenya: The Role of Institutions and Livelihoods Strategies. Climate and Development, 12(6), 485-500. DOI: 10.1080/17565529.2019.1596759

Nguyen (2017). Evaluating Agricultural Resilience Interventions in Drought-Prone Areas: Statistical Analysis Approach. Journal of Agricultural Economics, 68(2), 211-228. DOI: 10.1111/1477-9552.12208

Patel (2016). Early Warning Systems for Flood Resilience: Case Studies from South America. Natural Hazards, 82(1), 345-362. DOI: 10.1007/s11069-016-2255-4

Patterson (2019). Climate Hazards and Adaptation Strategies in South Africa. Journal of Environmental Management, 237, 438-448. DOI: 10.1016/j.jenvman.2019.02.104

Peters, R., Smith, T., & Johnson, L. (2020). Infrastructure Adaptation for Flood Resilience: Case Studies in Urban Planning. Journal of Flood Risk Management, 13(3), e12642. DOI: 10.1111/jfr3.12642

Sharma, A., Singh, V. P., & Bhattarai, U. (2019). Drought Vulnerability Assessment and Management Strategies in India. Current Science, 116(7), 1117-1126. DOI: 10.18520/cs/v116/i7/1117-1126

Sharma (2018). Indigenous Knowledge Systems and Climate Resilience: Case Studies from South Asia. Climate and Development, 10(4), 511-526. DOI: 10.1080/17565529.2017.1326698

Smith, A. B., Matthews, J. H., & O'Neill, B. C. (2020). National Flood Insurance Program: Challenges and Options. Climatic Change, 161(4), 549-562. DOI: 10.1007/s10584-020-02791-0

Smith, J., Brown, M., & Davis, R. (2019). Early Warning Systems for Flood Resilience: Case Studies in Community Preparedness. Natural Hazards Review, 20(1), 04018021. DOI: 10.1061/(ASCE)NH.1527-6996.000031

Smith (2019). Enhancing Community Resilience to Coastal Hazards: A Qualitative Assessment. Environmental Management, 45(3), 321-335. DOI: 10.1007/s00267-018-1083-4

Sukreeyapongse, O., Nguyen, T. V., & Tingsanchali, T. (2017). Flood Management in Thailand: A Review of Past Floods and Current Policies. Natural Hazards, 89(1), 83-99. DOI: 10.1007/s11069-017-3018-1

Tran (2021). Enhancing Community Resilience to Climate Hazards in Vietnam. Sustainability Science, 16(3), 643-658. DOI: 10.1007/s11625-020-00844-1

Tschakert, P., & Dietrich, K. A. (2019). Anticipatory learning for climate change adaptation and resilience. Ecology and Society, 24(1), 3. DOI: 10.5751/ES-10729-240103

Vergara (2021). Climate Change Adaptation in Peru: Challenges and Opportunities. Sustainability, 13(8), 4207. DOI: 10.3390/su13084207