building resilience
By Co-Creating for Climate Security

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காலநிலை பாதுகாப்பிற்காக இணை-உருவாக்கத்தின் மூலம்
தாங்குதிறனை விருத்திசெய்தல்

Climate and Conflict Vulnerability Mapping of Northern, Northwestern, Eastern and Uva Provinces of Sri Lanka

Sujeewa Dissanayaka, Nishadi Eriyagama, Karin Fernando, Nadiya Azmy, Thilini de Alwis, Minuri Perera, Lal Muthuwatta, Hashitha Ruwan Abeywardana, Shiraj Morugama, Sanjiv de Silva and Kumarathasan Vinopavan

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Cover photo

Farmers in Kilinochchi District discuss a project intervention with project staff (*photo:* Sharni Jayawardena).

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Collaborators

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Contents

List of Figures

List of Tables

Summary

This study assesses climate and conflict vulnerability in selected regions of the Northern, Northwestern, Eastern and Uva provinces in Sri Lanka. It examines how climate-related factors such as drought, flood and resource availability interact with socio-economic conditions, potentially influencing community vulnerabilities.

The assessment framework integrates six key dimensions: economic capacity, social resources, personal well-being, demographic aspects, climate exposure and climate sensitivity drivers. Using a Climate and Conflict Vulnerability Index, spatial analyses were conducted at the Divisional Secretariat (DS) level to identify areas with heightened vulnerability. The study finds that certain districts, including Trincomalee, Jaffna and Puttalam, exhibit relatively higher vulnerability due to a combination of environmental stressors and socio-economic factors.

A more focused analysis was undertaken in the Puttalam district to explore climate-induced stressors, particularly drought and their potential impact on water resource availability and livelihood dependencies. Field consultations and stakeholder engagements provided qualitative insights to validate and refine the findings, ensuring alignment with local perspectives. The study highlights that climate variability, access to essential resources and economic conditions play a meaningful role in shaping community resilience.

The findings of this assessment provide data-driven insights that can be useful for policymakers, development agencies and local authorities, when planning targeted adaptation and mitigation strategies. The study underscores the importance of integrating climate considerations into resource management and enhancing localized resilience-building efforts to minimize emerging risks.

This research was undertaken as part of the project “Building Resilience by Co-Creating for Climate Security”, supported by the Foreign, Commonwealth & Development Office (FCDO) of the United Kingdom, to contribute to ongoing discussions on climate vulnerability and its socio-economic implications in the studied regions.

1. Introduction

1.1 Basic Concept of Climate and Conflict Vulnerability

A definition of a conflict is when one party perceives that its interests/goals/aspirations are being opposed or negatively affected by another party (Wall and Callister 1995). Conflicts take place at different levels (i.e., individual, group, country) (Wall and Callister 1995). Conflicts can lead to violence and can impact national (state) security (Uppsala Conflict Data Program 2020). However, the United Nations Development Programme (UNDP) sees situations of conflict arising out of a lack of human security due to two aspects: "freedom from fear" and "freedom from want". This definition goes beyond national security built on military interventions and encapsulates seven aspects: economic, food, health, environment, personal, community and political security (UNDP 1994). Conflicts can arise due to the lack of any of these aspects (UNDP 1994). These situations of insecurity are further exacerbated and are intrinsically linked to the external shock of climate change (CEPA 2021). While climate change on its own is not seen as a source for conflict, climate change shocks (or hazards) can exacerbate incompatibilities and the chances of conflict among groups, by acting as threat multipliers (Lewis and Lenton 2015). There can, however, be underlying socio-economic and political hindrances that co-mingle with climate issues to heighten insecurities that then lead to grievances, tensions and ultimately, violent conflict (Lewis and Lenton 2015).

Since independence in 1948, Sri Lanka has been subject to a long history of conflict characterized by ethnic, socio-political imbalances and competing interests over the access to political rights, state power and resources. According to Uyangoda (2007), "group discrimination, limited access to public resources and cultural marginalization" were all key factors that led to the outbreak of the 26-year ethnic conflict between the Sinhalese majority and Tamil minority as well as the JVP uprisings. While political elites of both groups are blamed for manipulating and provoking ethno-nationalist narratives to contain inter-caste divisions, rising unemployment and inequalities between rural and urban areas also contribute to divisions (Perera 1992). It produced and institutionalized ethnic conflict as a way to either gain or hold on to state power. Thus, historically Sri Lanka's conflict drivers emerge from tensions between the different ethnoreligious groups and their competing narratives of historiographies (Uyangoda 2003). These have geographic variations, further complicated by urban–rural dimensions and by the fact that some regions of the country remain lagging—with less economic and service delivery—causing dissatisfaction among communities (Perera 2001). Another form of conflict or cause for disagreement arises around how resources should be distributed amongst competing groups. In many instances the resources in question are common pool resources — which are limited and shared (non-exclusive) resources used by a range of users—both human and non-human. These include water, land, marine and aquatic resources, air, and certain types of natural and physical capital. The use of these resources can lead to exploitation by some groups and degradation of the resource (Hardin 1994).

Conflicts can arise as a consequence of scarcity coupled with the way resources are managed and applied to the socio-political landscape (CEPA 2021). In terms of scarcity, there are three types: (a) supply-induced scarcity, which occurs due to degradation or depletion of resources that limits availability; (b) demand-induced scarcity, which results from population growth, new technologies or increased consumption rates that reduce resource availability; and (c) structural scarcity, where different groups in society face unequal resource access (Homer-Dixon 1999).

Where tanks and irrigation systems have fallen into disuse and disrepair, for example, in the case of the Imbulgodayagama small tank in the Anuradhapura district and in many similar situations across the dry zone, there is inadequate water storage and supply and a lack of cooperation amongst all the users to address the problem (GCF Sri Lanka 2016). Water sharing amongst different user groups can lead to fear of a lack of water for farming or drinking; as was the case with the large-scale project to develop the Iranamadu Tank in the Kilinochchi District, to supply water to the urban areas of Jaffna Town and as well as farmers in Kilinochchi. The farmers were concerned about the availability of water for cultivation during the dry season as a result of sharing water (CEPA 2021). These situations of scarcity can lead to some users fearing a lack of access due to social status and networks, location (upstream/downstream) or due to others extracting more as a result of better access to technology (ability to pump water). This can happen due to trade-offs, particular decisions on land use or other socio-economic, political and gender issues. For example, in the case of the Wedithalathive Nature Reserve in the Mannar district, decisions about the use of and access to resources by the local community were tied up with decisions made by two national bodies – one aimed to develop aquatic resources and the other aimed to conserve the coastal ecosystem. Other interested third-party groups like environmental lobbyists also joined the fray to protect the common good. Therefore, the decisions taken by state agencies, their mandates and management responsibilities, the needs of the local communities as well as public interests had to be considered (Wikramanayaka et al. 2017; CEPA 2021). Climate change can increase the stress on common resources, causing more human insecurity as the governance systems can become strained or fail altogether (Mann 2017). However, it is also important to note that every circumstance does not result in conflict or tensions but ensuring that these situations do not arise is also necessary. It is also important to recognize that such conflicts can arise at different points in time and can also be temporary (CEPA 2021).

1.1.1 Climate vulnerability and conflict

Thus far, it has been established that climatic and non-climatic issues converge and expose individuals and groups of people to its impacts. The coping capacity or vulnerability of individuals or groups to face these shocks, depends on different inherent features as well as their assets—such as gender, ethnicity, geography, status, income and education, and aspects such as networks and political capital (UNEP 2020). The vulnerabilities are experienced due to exposure to the hazard (climatic and non-climatic shocks) or can result as a consequence of the relief or response provided to the shock (Venton and La Trobe 2008; World Bank 2013; UNEP 2020). Literature shows that in areas with greater dependence on natural resources for livelihoods, areas already facing climate threats such as droughts, or where there are discriminatory institutions and high levels of poverty, these aspects impact the coping capacity and can increase the chance of conflict (World Bank 2013). When designing responses or adaptation measures, it is essential to account for the varying vulnerabilities and coping capacities of individuals and groups such as men, women, youth, the elderly and other socially marginalized groups. If these measures are not inclusive, fail to provide equitable access or do not address differentiated needs, they can disproportionately affect one group's human security over another's, potentially exacerbating insecurities and leading to conflict (UNEP 2020).

Maps have been used to identify areas of vulnerability to climate hazards such as flood, drought and sea level rise (Islam et al. 2013; Lam et al. 2015; Notenbaert et al. 2010) and health impacts such as malaria (Hagenlocher and Castro 2015), dengue (Dickin et al. 2013), extreme heat (Reid et al. 2009; Weber et al. 2015) and food insecurity (Kok et al. 2010; Thornton et al. 2008; van Wesenbeeck et al. 2016). There are several methodologies used to map vulnerabilities. Among others, the De Sherbinin et al. (2019) systemic review on climate vulnerability maps suggests the following: The review finds some convergence around common frameworks developed by the Intergovernmental Panel on Climate Change (IPCC), frequent use of linear index aggregation and common approaches to the selection and use of climate and socioeconomic data. Further, it identifies limitations in the frameworks such as a lack of future climate and socioeconomic projections in many studies, insufficient characterization of uncertainty, challenges in map validation and insufficient engagement with policy audiences for those studies that purport to be policy relevant. Finally, it provides recommendations for addressing the identified shortcomings.

Climate change vulnerability maps are used to direct attention to geographic areas where impacts on society are expected to be greatest and may therefore require adaptation interventions. In the context of Sri Lanka, Eriyagama et al. (2009) mapped climate change vulnerability of water resources and agriculture. This study proposed an index of climate vulnerability, composed of three subindices representing exposure, sensitivity and adaptive capacity, to identify hotspots of agricultural vulnerability in Sri Lanka. The assessment considers all districts in Sri Lanka except those lying within the Northern Province and the Trincomalee District in the Eastern Province. In addition, the Ministry of Environment (2011) published a vulnerability data book mapping climate change vulnerability of all areas except the North and East due to census data unavailability at the time. This methodology also used GIS mapping to develop indices for exposure, sensitivity and adaptive capacity.

We did not come across any climate change and conflict vulnerability mapping done in Sri Lanka. However, Busby et al. (2014) mapped climate security vulnerability in Africa with the aim of identifying places that are most vulnerable to climate security concerns. The study's focus on security looked at situations where there were a large number of people with mass deaths from exposure to climate hazards. The maps highlighted the vulnerability of locations relative to Africa rather than the rest of the world. In addition, Kenduiywo et al. (2023) mapped climate insecurity hotspots in East Africa and the Greater Horn of Africa –specifically, Sudan, South Sudan, Ethiopia, Somalia, Kenya, and Uganda. This study aimed at mapping the climate-security nexus by identifying locations where different conditions of climate, conflict and socioeconomic vulnerabilities co-occur.

The vulnerability of a community to a climate hazard, depends not only on the level of exposure to the hazard itself but also on the likelihood of being negatively impacted by the hazard, as well as its ability to cope with and adapt to changing circumstances created by the hazard. The presence of conflict within a community usually increases its sensitivity (likelihood of negative impact) to external shocks, including climate shocks and decreases its coping and adaptive capacities. On the other hand, being exposed to frequent climate hazards and its resulting damage to property and livelihoods can increase conflict over available resources and lead to displacement, compromising human security. Utilizing previous mapping and literature reviews, the study shortlisted several provinces that had a high vulnerability to hazards and contextual issues that showed high insecurities. Therefore, this study focused on the Northern, Northwestern, Eastern and Uva provinces of Sri Lanka, and attempted to move beyond a typical climate vulnerability assessment and capture elements of conflict within communities by combining climate vulnerability with a Conflict Vulnerability Assessment (CVA).

CVAs are a crucial tool for understanding and reducing the risk of conflict in a specific region or community. The purpose of a CVA is to identify the factors that contribute to conflict and to develop strategies to reduce or mitigate the impact of these factors. By identifying the most vulnerable areas and populations, CVAs provide crucial information for developing targeted interventions that promote stability, security and peace.

A CVA typically includes an analysis of multiple indicators, including economic, social, personal well-being and demographic indicators, as well as other relevant factors. For example, economic indicators might include poverty rates, household income and access to financial services, while social indicators might include access to education and health services. Demographic indicators might include population density as well as the ethnic and religious composition of the area. Therefore, this study combined the above indicators with indicators of climate exposure and climate sensitivity, with a special focus on access to water resources, to create a "Climate and Conflict Vulnerability" index. This Index was mapped at the DS division level within the selected provinces.

It is hoped that this assessment will be useful for a variety of stakeholders, including government agencies, non-government organizations and international organizations. By providing a holistic understanding of the vulnerability of climate and conflict, the assessment can help these organizations to prioritize their resources and focus their efforts on where they are needed the most. In addition, it can also serve as a baseline for monitoring and evaluation, allowing organizations to assess the effectiveness of their interventions over time.

2. Indicator Identification

The selection of indicators for the climate and conflict vulnerability assessment was crucial for understanding the interplay between climate and conflict. The indicators were selected in such a way as to provide a multi-dimensional understanding of the impacts of both climate and conflict, on communities, economies and the environment. Indicators were selected under the broad categories listed below based on the availability of secondary data.

1. Economic capacity
2. Social resources
3. Personal well-being
4. Demographic factors
5. Climate exposure
6. Climate sensitivity drivers

The indicators listed covered important dimensions of the impact of climate and conflict vulnerability on communities. The economic indicators were drawn from underlying economic conditions that can cause conflicts or insecurities in the face of climate change. For example, lack of access to jobs or employment opportunities increases vulnerability to deal with climate shocks. Social indicators aimed to understand the impact of climate and conflict on social cohesion, like access to resources. Personal well-being indicators assessed the extent to which communities were protected from harm and had access to essential services. Demographic indicators focused on the impact of climate and conflict on the population. Climate exposure indicators assessed the extent to which communities were exposed to the impacts of historically extreme weather events and landslides. Climate sensitivity indicators focused on the capacity of communities to adapt to the impacts of climate change.

2.1 Economic Capacity for Climate and Conflict Vulnerability

Indicators selected under the broad category of economic capacity are detailed below. These indicators were identified as being highly relevant, primarily based on the nature of livelihoods practiced within the four provinces analyzed. Economic insecurities refer to tensions that can arise from underlying conditions such as a lack of access to jobs or inadequate income, that can increase the vulnerability to deal with climate shock. For livelihoods relying on common pool resources, existing insecurities or grievances due to economic opportunity, can worsen when there is scarcity or competition over resources or differentiated access to support (training, financing, technology).

- **Poverty rate:** This refers to the proportion of people in a population who are living below the poverty line, which is a set consumption expenditure level below which individuals are considered to be unable to afford the necessities of life. High poverty rates can create greater insecurities, reducing adaptive capacity and increasing conflict vulnerability.
- **Household income:** This refers to the total income received by a household in a given time period, including earnings from employment, investments and other sources. Low household income can limit access to basic needs, increase financial stress and reduce adaptive capacity to climate-related shocks.
- **Unemployment rate:** The unemployment rate, representing the percentage of the workforce actively seeking employment, has broad societal implications. High unemployment can lead to increased poverty, social unrest and heightened vulnerability to conflict during climate-related shocks.

- **Access to financial services:** This refers to the availability and accessibility of financial services, such as banking, credit and insurance, in a given area. Lack of access to financial services can limit opportunities for economic growth, increase poverty and make individuals and communities more vulnerable to conflict-related economic shocks while reducing coping capacity to climate shocks.
- **Total agricultural area (per household):** This refers to the amount of land used for agricultural purposes, usually expressed in hectares, per household.
- **Paddy production (annual total in bushels):** This refers to the total production of paddy or rice, in a given area during a specific year, expressed in bushels.
- **Cow's milk (L):** This refers to the total amount of cow's milk produced in a given area during a specific time period, expressed in liters.
- **Buffalo milk (L):** This refers to the total amount of buffalo milk produced in a given area during a specific time period, expressed in liters.
- **Eggs (numbers):** This refers to the total number of eggs produced in a given area during a specific time period.
- **Farm animals - total:** This refers to the total number of farm animals, including cattle, buffaloes, goats and pigs, in a given area during a specific time period.
- **Number of poultry total:** This refers to the total number of poultry, including chickens, ducks and turkeys, in a given area during a specific time period.
- **Slaughter statistics number of animals - total:** This refers to the total number of cattle, goats and pigs that are slaughtered for meat in a given area during a specific time period.
- **Coconut + coconut with pineapple (extent in hectares):** This refers to the extent of land used for growing coconuts and coconut with pineapple, expressed in hectares. Coconut and coconut with pineapple are important crops for many households, providing food, income and other benefits.
- **Sparsely used croplands/chena (extent in hectares):** This refers to the extent of land used for sparsely used croplands or chena (a type of slash-and-burn cultivation), expressed in hectares. Chena is an important form of agriculture for many households, providing food and income.
- **Fruit crop (extent in hectares):** This refers to the extent of land used for growing fruit crops, expressed in hectares.
- **Extent of homesteads/home gardens (extent in hectares):** This refers to the extent of land used for homesteads or home gardens, expressed in hectares.
- **No. of Samurdhi beneficiary families by Divisional Secretariat Division (DSD) 2018:** This refers to the number of families that are beneficiaries of the "Samurdhi" program (a poverty reduction program in Sri Lanka). Beneficiaries of the program are usually some of the poorest and most vulnerable households in a given area.
- **Number of beneficiaries under the disability allowance:** This refers to the number of individuals who are beneficiaries of a disability allowance, which provides financial support to individuals with disabilities. As the number of people with disabilities in a particular area grows, it can have various effects, particularly on the economy. This increase in numbers may potentially lead to conflicts.
- **Public assistance recipients:** This indicator pertains to the number of individuals or households receiving public assistance in a given area. Public assistance may encompass a range of social welfare programs designed to provide financial aid, food support or other essential resources to vulnerable populations. The count of public assistance recipients reflects the level of need within a community and serves as a crucial measure for assessing social and economic well-being.

2.2 Social Resources and Conflict Vulnerability

The existing inequalities in terms of social capital—such as health services, health status of individuals, education services and educational achievements, community networks and support—impact how individuals and households deal with a climate event. When there is a climate threat such as flood or drought, if some groups are not able to access these services or poor educational status reduces the options available, the coping capacity and resilience will be minimal.

- **Access to education:** Access to education is an important factor in reducing the risk of conflict. While education can provide individuals with the skills and knowledge they need to participate in economic and political activities, it can also promote social and economic stability. Disruptions in access to education, such as school closures or violence in educational facilities, can increase conflict vulnerability.
- **Literacy rate:** Literacy rates are an important indicator of a population's level of education. A high literacy rate can indicate that a significant portion of the population has access to education and has developed basic skills in reading, writing and numeracy. Low literacy rates on the other hand, can increase conflict vulnerability by reducing the ability of individuals to participate in economic and political activities.
- **Student/teacher ratio:** The student/teacher ratio is a measure of the number of students per teacher in a school or educational facility. A high student/teacher ratio can indicate a lack of resources, which can lead to overcrowded classrooms and a lower quality of education. This can increase conflict vulnerability by reducing access to education and the quality of education available to individuals.
- **Number of hospitals/clinics:** The number of hospitals and clinics in a region can indicate the availability of healthcare services. A lack of healthcare facilities can increase conflict vulnerability by reducing access to healthcare services, which can lead to negative health outcomes and increased social tensions.
- **Number of wards in hospitals/clinics:** The number of wards in hospitals and clinics can indicate the capacity of healthcare facilities to provide care. A lack of capacity in healthcare facilities can increase conflict vulnerability by reducing access to healthcare services and increasing the risk of negative health outcomes.
- **Number of beds in hospitals/clinics:** The number of beds in hospitals and clinics can indicate the capacity of healthcare facilities to provide care. A lack of capacity in healthcare facilities can increase conflict vulnerability by reducing access to healthcare services and increasing the risk of negative health outcomes.
- **Road density (km/ km^2):** This indicator reflects the accessibility of transportation infrastructure. Higher road density generally improves access to essential services and economic opportunities. Conversely, low road density can make it more difficult for people to reach essential services, thereby increasing their vulnerability to conflict and the impacts of climate change.
- **Number of midwives per DSD:** The presence of skilled healthcare professionals is a crucial component of a region's social resources and contributes significantly to reducing conflict vulnerability. This indicator assesses the availability of midwives per DSD, reflecting on the capacity to provide essential maternal and reproductive healthcare services. Adequate numbers of midwives can enhance the well-being of communities by ensuring safe pregnancies and childbirth, thereby contributing to social stability and mitigating conflict risks associated with health-related concerns.
- **Various societies by DSD:** Social cohesion and community engagement are fundamental in fostering resilience and reducing the likelihood of conflict. This indicator examines the presence of various societies or community groups within each DSD. These groups play a vital role in promoting social integration, addressing local issues and facilitating collaboration. Robust community networks can act as a buffer against conflict by promoting dialogue and understanding among diverse groups within the region.
- **Communications Index (number of cellular subscribers):** The accessibility of communication infrastructure is a key element in the social fabric of a region. This indicator, measured by the number of cellular subscribers,

reflects the extent of connectivity and access to information. A higher communications index indicates improved communication capabilities which can enhance emergency response, disseminate important information and foster economic activities. In contrast, low connectivity may heighten conflict vulnerability by limiting access to timely information and hindering effective communication amongst community members.

2.3 Personal Well-Being and Conflict Vulnerability

The status of one's individual circumstances—such as the condition of housing, water supply and assets—can lead to differentiated impacts during a climate event. This itself can discriminate some households over others. Insecurities or tensions can arise based on how these groups are affected and who gets access to relief or common pool resources.

- **Access to shelter and housing:** Access to shelter and housing is a fundamental aspect of human security. A lack of access to adequate shelter and housing can increase conflict vulnerability by leading to displacement, overcrowding and poverty.
- **Access to safe drinking water:** Access to safe drinking water is critical for health and well-being. A lack of access to safe drinking water can increase conflict vulnerability by leading to negative health outcomes, such as waterborne diseases and increase the risk of conflict over access to water resources.
- **Percentage underweight:** The percentage of the population that is underweight can indicate a lack of access to adequate nutrition. A high percentage of underweight individuals can increase conflict vulnerability by reducing the ability of individuals to participate in economic and political activities and increasing the risk of negative health outcomes.
- **Percentage stunting:** The percentage of children under five years who are stunted can indicate a lack of access to adequate nutrition during critical periods of growth and development. A high percentage of stunted children can increase conflict vulnerability by reducing the ability of individuals to participate in economic and political activities and increasing the risk of negative health outcomes.
- **Percentage wasting:** The percentage of children under five years who are wasted can indicate a lack of access to adequate nutrition during times of food insecurity or crisis. A high percentage of wasted children can increase conflict vulnerability by reducing the ability of individuals to participate in economic and political activities and increasing the risk of negative health outcomes.
- **Percentage of pregnant mothers with Body Mass Index (BMI) < 18.5:** The percentage of pregnant mothers with a BMI less than 18.5 can indicate a lack of access to adequate nutrition, which can increase the risk of complications during pregnancy and childbirth.
- **Percentage of pregnant mothers with anemia:** The percentage of pregnant mothers with anemia can indicate a lack of access to adequate nutrition, which can increase the risk of complications during pregnancy and childbirth.
- **Number of low-weight births:** The number of low-weight births can indicate a lack of access to adequate nutrition during pregnancy, which can increase the risk of negative health outcomes for both the mother and the baby.

2.4 Demographic Factors

Demographic factors—such as population density, gender, ethnicity, dependency ratios—affect the extent to which a climate threat can impact the well-being of a locality or household. This can lead to new insecurities or tensions or exacerbate already existing insecurities or tensions. For example, in areas with a higher population density, scarcity can increase competition for resources and can lead to insecurities or tensions due to inequalities in access. Accessing resources can also be gendered or based on caste or ethnicity, particularly when certain groups feel that their rights or cultural practices, access to services and livelihood opportunities or safety are threatened.

- **Population density:** A high population density creates a higher stress on available natural resources in the geographic area. This competition for scarce resources can trigger conflicts.
- **Dependency ratio:** This refers to the ratio of the number of people who are too young or too old to work, to the number of people who are of working age. A high dependency ratio can put a strain on resources and lead to conflicts, particularly in areas where the younger generation is unable to find employment.
- **Ethnic and religious composition:** Differences in ethnicity and religion can lead to tensions and conflicts, particularly when certain groups feel that their rights or cultural practices, or access to services and livelihood opportunities are threatened. CEPA's previous study (CEPA 2021) on climate change and conflicts, shows that such demographic differences can compound tensions over natural resource sharing.
- **Sex ratio:** Sex ratio can be an indication of underlying conflicts, particularly when women are denied equal access to resources and opportunities. Studies show that women are impacted differently and more severely by climate change-related disasters. The sex ratio in each DSD was chosen as a proxy indicator for gendered vulnerabilities.

2.5 Climate Exposure

The following indicators are intended to capture the extent to which communities are exposed to different climate shocks or extremes. Such exposure may contribute to resource-related challenges and displacement, which in turn could influence conflict dynamics and impact human security.

- **Exposure risk for wind:** This indicator assesses the risk of exposure to wind events, such as high winds, which can damage infrastructure and homes, disrupt transportation and communication systems, and lead to power outages and food shortages.
- **Exposure risk for cyclone:** This indicator assesses the risk of exposure to cyclones, which can cause widespread damage to infrastructure, homes and crops, disrupt transportation and communication systems, and lead to power outages and food shortages.
- **Exposure risk for drought:** This indicator assesses the risk of exposure to droughts, which can lead to crop failures, water scarcity and decreased access to food and water.
- **Exposure risk for flood:** This indicator assesses the risk of exposure to floods, which can damage infrastructure and homes, disrupt transportation and communication systems, and lead to power outages and food shortages.
- **Exposure risk for heavy rainfall:** This indicator assesses the risk of exposure to heavy rainfall, which can lead to flash floods, landslides and damage to infrastructure and homes.
- **Exposure risk for landslide:** This indicator assesses the risk of exposure to landslides, which can damage infrastructure, homes and crops, disrupt transportation and communication systems, and lead to power outages and food shortages.

2.6 Climate Sensitivity Drivers

- **Rural population density (population/ km²):** This indicator measures the concentration of people living in rural areas who are more likely than urban communities to rely on natural resource-based livelihoods. Therefore, high population density can increase the vulnerability of communities to the impacts of climate change, as they may be more susceptible to food and water insecurity and may have limited access to healthcare and other essential services.
- **Estate population density (population/ km²):** This indicator measures the concentration of people living in estate areas. High population density in estate areas may increase food and water insecurity, and increase competition for healthcare and essential services, while climate shocks may exacerbate existing crises.
- **Agricultural operators (crop cultivators) by Divisional Secretariat (DS):** An increase in the number of agricultural operators may create competition for resources such as land, water and other agricultural inputs. This competition can lead to conflicts among farmers, as they compete for the same resources.
- **Agricultural operators (animal husbandry with aquaculture) by DS:** This indicator focuses on the number of agricultural operators engaged in animal husbandry with aquaculture activities within each DS. The inclusion of animal husbandry and aquaculture in agricultural practices introduces a multifaceted dimension to the region's climate sensitivity drivers. Increased participation in these activities may heighten competition for resources such as land, water and other inputs essential for both agriculture and aquaculture. The potential for conflict arises, as farmers and operators may find themselves competing for shared resources, leading to tensions within the community. Understanding the dynamics of agricultural operators involved in animal husbandry with aquaculture, is crucial for identifying potential stressors on local resources and implementing sustainable practices to mitigate conflicts and enhance the overall climate resilience of the region.
- **Percentage of paddy area served by major irrigation schemes:** This indicator measures the percentage of paddy fields that are irrigated by major irrigation schemes. Irrigation is an important factor in agriculture and food security, and changes in rainfall patterns due to climate change can impact the availability of water for irrigation, leading to reduced productivity and increased vulnerability. Expanding major irrigation schemes can decrease the risk of crop damage by ensuring greater water availability, thereby reducing the vulnerability to climate variability and extremes.
- **Percentage of paddy area served by minor irrigation schemes:** This indicator measures the percentage of paddy fields that are irrigated by minor irrigation schemes. Irrigation is an important factor in agriculture and food security, and changes in rainfall patterns due to climate change can impact the availability of water for irrigation, leading to reduced productivity and increased vulnerability. Expanding minor irrigation schemes can ensure greater water availability, thereby reducing the vulnerability to climate variability and extremes.
- **Percentage of paddy area rainfed:** This indicator measures the percentage of paddy fields that are rainfed. Rainfed agriculture is vulnerable to changes in rainfall patterns due to climate change, which can impact food security and increase the vulnerability of communities. Expanding the rainfed paddy cultivation area can increase the risk of crop failure due to climate variability.
- **Farm diversity (Crop Diversity Index – CDI):** This composite index measures the diversity of crops grown in a given area. A high degree of farm diversity can increase the resilience of communities to the impacts of climate change, as they may be better able to adapt to changes in rainfall patterns or other environmental conditions. A low degree of farm diversity can increase the vulnerability of communities to the impacts of climate change, as they may be more susceptible to food and water insecurity.
- **History of conflict, war or violence:** The historical impact of conflict, war or violence is a critical factor to consider in a CVA. A history of conflict can have a lasting impact on a region or community, shaping attitudes and relationships, and affecting the likelihood of future conflict.

  The presence of a history of conflict, war or violence in an area can increase the vulnerability of a population to future conflict, especially if the conflict has not been resolved or if tensions and mistrust remain. This history can impact a population in a variety of ways; such as creating a culture of violence, disrupting social and economic systems and causing psychological trauma.

In addition, the legacy of past conflict can also affect relationships between different ethnic or religious groups, exacerbating tensions and increasing the risk of future conflict. Furthermore, past conflict can also have an impact on the availability of resources, such as access to land, housing and economic opportunities, which can increase the risk of conflict.

For these reasons, it is important to consider the history of conflict, war or violence when conducting a CVA. By understanding the historical context and the lasting impact of past conflict, it is possible to develop strategies to reduce the risk of future conflict and promote stability and peace.

3. Methodology

This study established a methodological framework for creating an index that assesses the susceptibility of Divisional Secretariat Divisions (DSDs) to both climate and conflict, considering several dimensions. The Vulnerability Index, encompassing climate and conflict, adopts a holistic approach, considering variables that define a composite status based on empirical research and the reflexivity inherent in knowledge and social practices.

Recognizing the absence of direct or explicit measurement scales for conceptual definitions such as satisfaction, happiness, sustainability, climate and conflict vulnerability, this study employs a practical approach. Assessments based on multiple variables are amalgamated into a composite index, to quantify these intricate concepts. A multivariate approach, specifically a factor/principal component analysis, is employed to amalgamate data within the multidimensional data space, into a condensed set of factors strategically covering key domains related to climate and conflict vulnerability.

The resulting factors are subsequently combined to formulate a single index that encapsulates the climate and conflict vulnerability status of DSDs (Figure 1). This methodology, involving the extraction of a limited number of factors from a myriad of interconnected variables gathered from diverse sources, effectively captures the inherent unique variability within the original data.

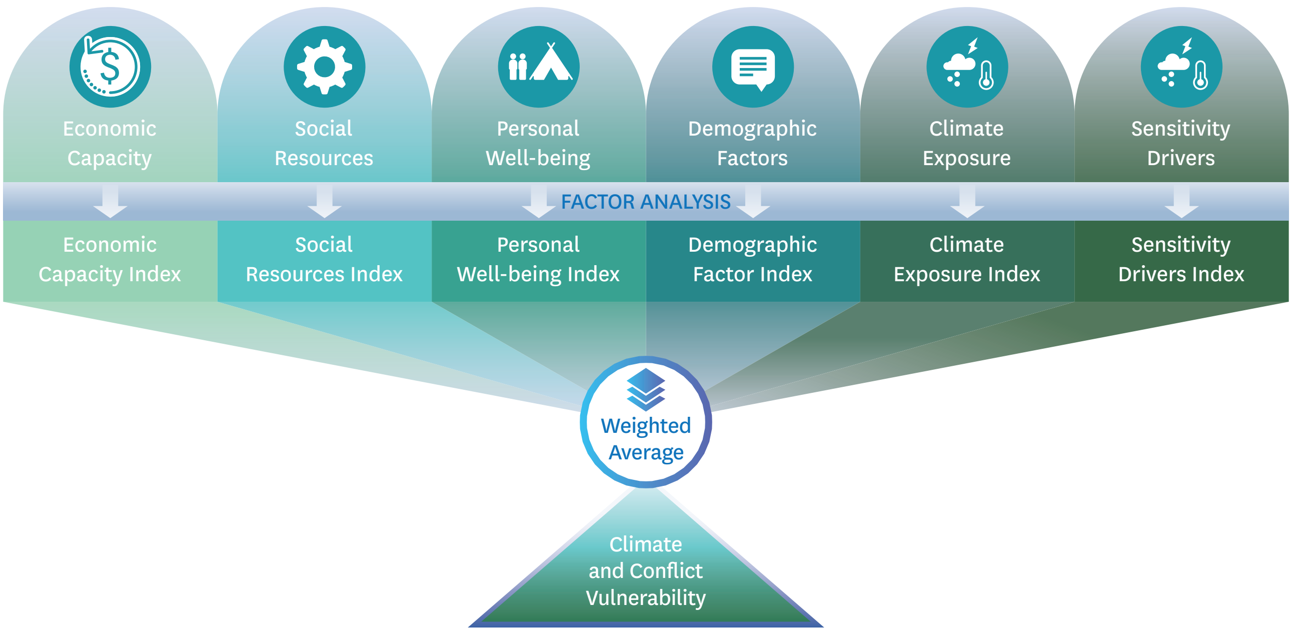

Figure 1. Flow chart of methodology.

Compiling the composite index using factor/principal component analysis, is aimed at providing a clear overview of complex issues without complicated data manipulations or arbitrary weight assignments. In creating the Climate and Conflict Vulnerability Index, more than 50 variables were identified through the review of past studies and consultations with experts. Notably, only variables with sub-national spatial demarcation up to the DSD level were included, excluding national composite values. To simplify the data, factor/principal component analysis was employed to address common variance concerns, ensuring a transparent and straightforward approach to understanding vulnerability. The resulting composite index was mapped at DSD level across the four provinces. The maps were validated and updated by conducting stakeholder consultations at the national and sub-national level.

3.1 Study Area

As stated earlier, the climate and conflict vulnerability assessment was conducted in the four provinces: Eastern, Northwestern, Northern and Uva (Figure 2). This strategic selection encompasses 12 districts within these provinces, ensuring a thorough examination of the identified regions. The assessment also involved engaging with 151 Divisional Secretaries to gather relevant insights and data.

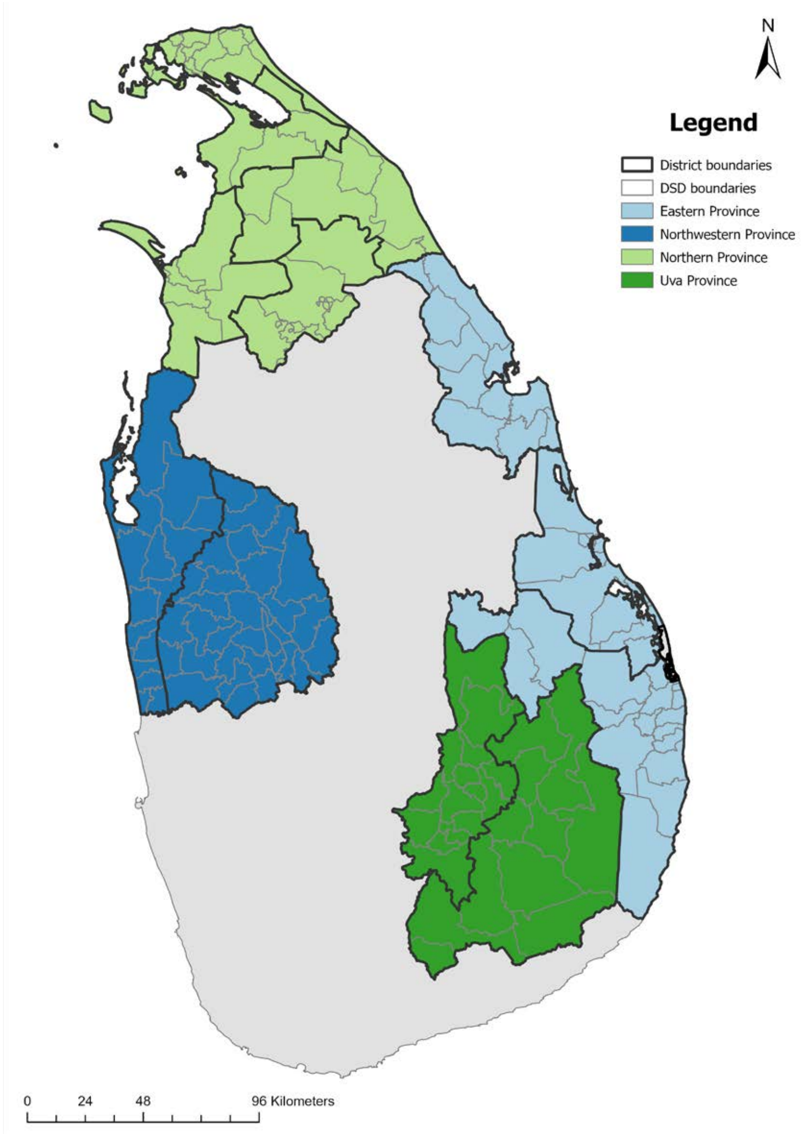

Figure 2. Study area map.

3.2 Variables Normalization and Inversion

The normalization and inversion of variables play a pivotal role in the process of data aggregation, especially when working with datasets that encompass indicators of varying units of measurement. The fundamental objective of aggregation is to enable meaningful comparisons between these diverse indicators. There are several methods for normalization, with the most common being the z-score and minimum-maximum conversion, especially when dealing with comprehensive indicators. In this investigation, we utilized minimum-maximum conversion and rescaling techniques.

The study focuses on analyzing climate and conflict vulnerability at the DSD level. When evaluating indicators that signify an unfavorable situation, such as a higher poverty rate or an elevated dependency ratio in a specific DSD, a higher index value indicates increased vulnerability for that division. Each variable underwent a thorough analysis and those representing a dimension not aligning with vulnerability were inverted. This step ensured that for every variable, climate and conflict vulnerability increased with a rise in the variable's value.

During the normalization process, the DSD with the highest vulnerability was assigned a value of 100, while the one with the lowest vulnerability received a value of 0. Values for other DSDs were calculated proportionately within this range. These normalized variable sets constitute distinct indices and serve as vital indicators in the subsequent analysis of climate and conflict vulnerability.

3.3 Data Analysis

SPSS and ArcGIS Pro software were used to analyze the collected data. Factor analysis was employed for the reduction of dimensionality of the large number of variables selected for the study. The flow chart of the overall methodology of the data analysis is shown in Figure 1.

3.3.1 Application of factor analysis on the reduction of dimensionality

Factor analysis serves as a method for dimension reduction in multivariate statistical analysis. It yields linear combinations of a set of variables, generating uncorrelated components. The objective is to derive a concise representation where the initial components, through their linear combinations, elucidate a significant portion of the variance within the original set of variables.

Each observed variable (y) is expressed as a weighted composite of latent variables (f's) as shown in Equation (1):

$$y_i = a_{i1} f_1 + a_{i2} f_2 + \cdots + a_{ik} f_k + e_i \qquad \text{(Equation 1)}$$

Where y_i is the i^{th} observed variable on the factors, e_i is the residual of y_i on the factors. Given the assumption that the residuals are uncorrelated across the observed variables, the correlations among the observed variables are accounted for by the factors (De Silva 2007).

3.3.2 Aggregation of variables

All the variables were assigned equal weighting (EW) and no higher preference for any variable was considered. This could correspond to the case in which all variables are "worth" the same in the composite and in any case, equal weighting does not mean "no weights", but implicitly implies the weights are equal.

3.3.3 Calculation of Climate and Conflict Vulnerability Index for separate categories

Vulnerability indices were calculated for six separate categories; namely economic capacity, social resources, personal well-being, demographic factors, climate exposure and climate sensitivity drivers. A Climate and Conflict Vulnerability Index was computed for all six categories separately.

Loadings of factors that have eigenvalues greater than one, were used to create an index for each category and eigenvalues were used as the corresponding weights. The proportional contribution of each factor (ai) was weighed using eigenvalues as given in Equation 2. The Vulnerability Index of each category for each DS was derived as the weight of eigenvalue that comes from Equation 2, which was imported into the summation of the values coming from the multiplication of the actual value of the variable by the relevant factor loading as in Equation 3. This calculation used only high impact variables according to the factor loadings of each factor. It means that the factors with factor loading greater than 0.5, were only considered in the calculation of the indicator value (De Silva 2007).

$$\alpha_i = \frac{\lambda_i}{\Sigma_\lambda} \qquad \text{(Equation 2)}$$

α_i = Weight of the ith factor
λ_i = Eigen value of ith factor
Σ_λ = Summation of eigen values for all factors

$$\text{Vulnerability Index for DS} = \Sigma \boldsymbol{\alpha_i} \, \Sigma \, (\boldsymbol{X_j} * \boldsymbol{F_{ij}}) \qquad \text{(Equation 3)}$$

α_i = Weight of the ith factor
X_j = Normalized indicator of jth variable of the category
F_{ij} = ith factor loading of jth variable

3.3.4 Calculation of overall climate and conflict vulnerability

By using Equations 2 and 3, the climate and conflict vulnerability indices were calculated for each of the six individual categories. These indices were then combined to create a composite index that represents the overall climate and conflict vulnerability. Equal weight was given to each category when combining them into one. The resulting values of the index were ranked into five groups or classes (critically vulnerable, vulnerable, moderately vulnerable, less vulnerable and least vulnerable) according to Natural Break Classification criteria. Therefore, DSDs having the highest climate and conflict vulnerability were grouped into the critically vulnerable category, while those having the lowest climate and conflict vulnerability were grouped into the least vulnerable category.

Climate and conflict vulnerability indices of the six individual categories and the overall index were mapped using ArcGIS Pro. Maps indicating vulnerability for each category and the final overall index, were prepared using the calculated values of the vulnerability index for all the DSDs within the four provinces.

In the Natural Breaks Classification method used in mapping, classes are based on natural groupings inherent in the data. The classification algorithm identifies breakpoints by determining class breaks that best group similar values and maximizes the difference between an actual value and the mean of its assigned range in each class. The resulting maps are presented in section 4.1 below.

In addition to considering the combined exposure to historical climate extremes (under climate exposure impact), maps were also produced considering exposure to each individual type of extreme event. For example, the map for drought exposure considers exposure to historical drought events in deriving the Climate Exposure Index and this index is combined with the other five indices under equal weights.

4. Results and Discussion

This section presents results of the climate and conflict vulnerability analysis conducted in the four provinces. The smaller spatial units on the maps facilitate a clear visualization of value distribution, allowing easy reference to original variables for potential interventions. The Natural Breaks Classification method to categorize results sheds light on inherent gaps in the resulting value series. Moreover, employing factor analysis enables a deeper understanding of causative variables, providing valuable insights to inform the formulation of effective policies aimed at improving the current situation.

4.1 Indices for Each Main category

4.1.1 Economic capacity impact on climate and conflict vulnerability

Economic Capacity Index

Figure 3 shows the scree plot which visually represents the significance of economic indicators, while factor loading weights identify the contribution of each factor (Table 1). The rotated component matrix refines our understanding of the interplay between different economic indicators, highlighting key factors that demand attention in policy formulation (Table 2).

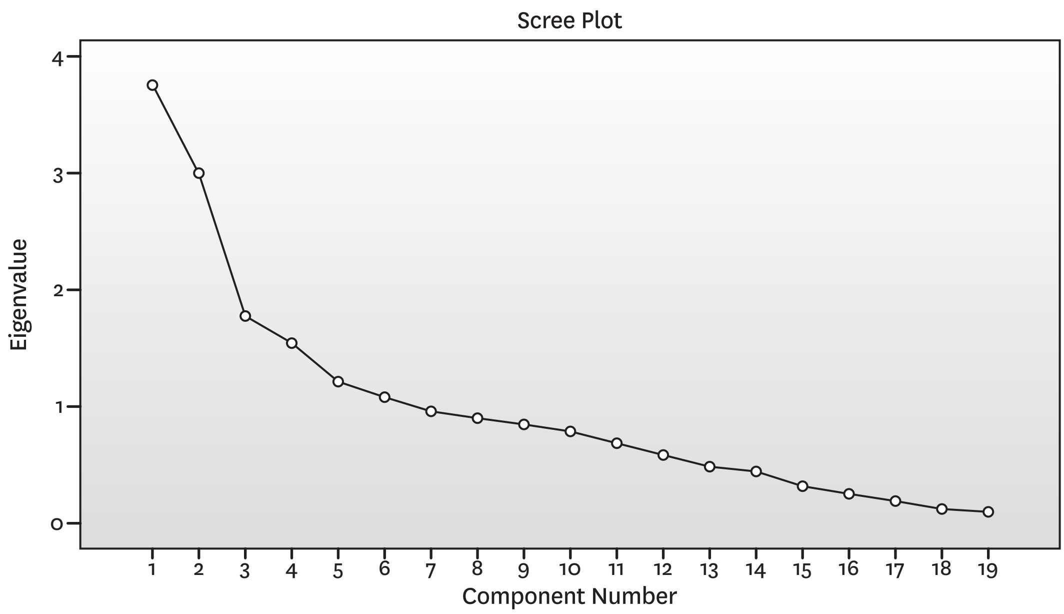

Figure 3. Scree plot for economic indicators.

Table 1. Factor loading weights for economic capacity impact on climate and conflict vulnerability.

Factors	Weight
1	23.69
2	21.75
3	21.01
4	11.85
5	11.66
6	10.04

Table 2. Factor loading values in rotated component matrix.

Rotated Component Matrix						
	Component (factors)					
	1	2	3	4	5	6
Unemployment rate				.592		
Poverty rate	-.791					
Total agricultural area (per household)			.626			
Paddy production (annual total in BUSHELS)	.587				.506	
Cow's milk (L)		.532				
Buffalo milk (L)	.599					
Eggs (numbers)		.915				
Farm animals (cattle, buffaloes, goats, pigs) total	.770					
Number of poultry (cocks/hens, ducks, turkeys) total		.924				
Slaughter statistics (cattle, goats and pigs) Number of animals - total				-.561		
Coconut + coconut with pineapple (extent in hectares)		.590	.442			
Sparsely used croplands/chena (extent in hectares)						
Fruit crop (extent in hectares)						.833
Extent of homesteads/home gardens (extent in hectares)				.616		
Access to financial services			.738			
Household income	-.733					
Number of Samurdhi beneficiary families by Divisional Secretariat Division (DSD)			-.810			
Number of beneficiaries under the disability allowance					.797	
Public assistance recipients			-.410			

The rotated component matrix, as presented in Table 2, unveils critical insights into the factors influencing the Vulnerability Index for Economic Capacity. Among the key components, the analysis highlights the substantial impact of various economic indicators. Notably, factors such as high factor loadings for eggs (numbers), total number of poultry (cocks/hens, ducks, turkeys) and fruit crop extent (hectares) indicate a significant positive correlation. Conversely, indicators like poverty rate, slaughter statistics (cattle, goats and pigs) and the number of Samurdhi beneficiary families by DSD, exhibit negative correlations. These findings underscore the nuanced interplay of diverse economic elements in influencing the overall Economic Capacity Index. The resulting Economic Capacity Index map is shown in Figure 4.

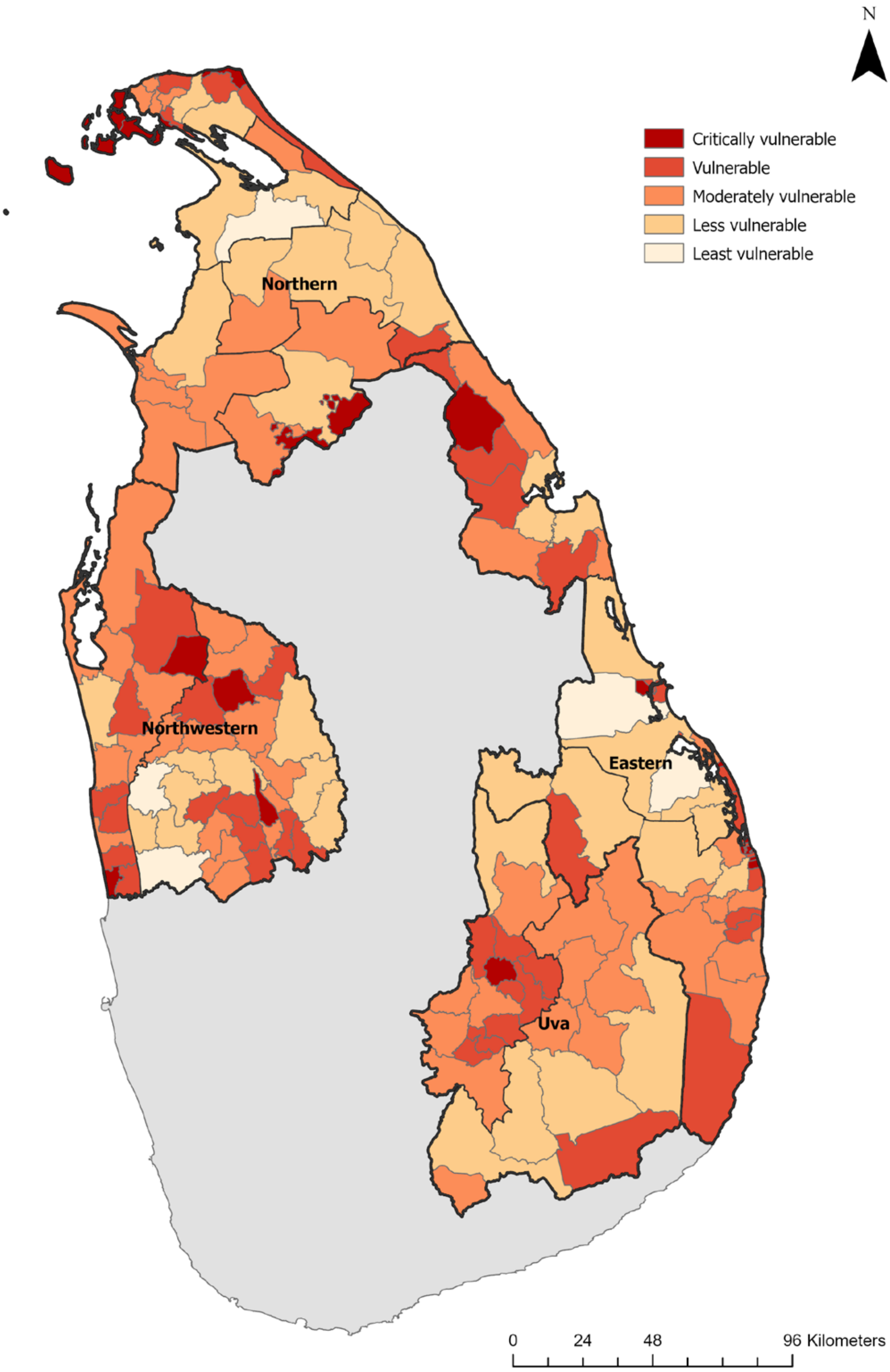

Figure 4. Economic capacity impact on climate and conflict vulnerability map.

4.1.2 Social resources impact on climate and conflict vulnerability

Vulnerability Index for Social Resources

Figure 5 shows the scree plot which visually represents the significance of social resource indicators, while factor loading weights identify the contribution of each factor (Table 3). The rotated component matrix refines our understanding of the interplay between different social resource indicators, highlighting key factors that demand attention in policy formulation (Table 4).

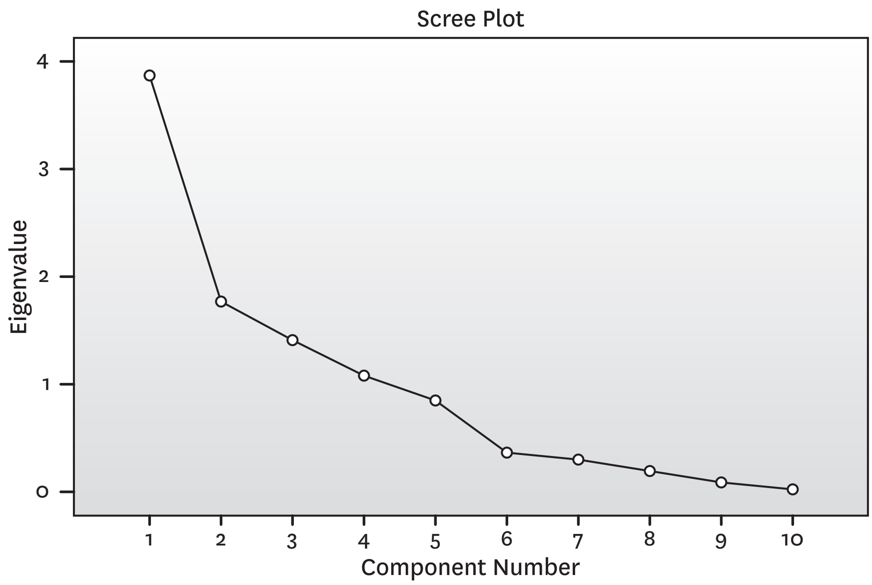

Figure 5. Scree plot for social indicators.

Table 3. Factor loading weights for social resources impact on climate and conflict vulnerability.

Component	Weight
1	36.40
2	26.79
3	19.69
4	17.11

Table 4. Factor loading values in rotated component matrix for social resources impact on climate and conflict vulnerability.

Rotated Component Matrix				
	Component (factors)			
	1	2	3	4
Literacy rate (O/L passed %)			.930	
Access to education	.890			
Student/teacher ratio				.873
No. of hospitals/clinics	.540			.580
No. of wards in hospitals/clinics		.929		
No of beds in hospital/clinic		.959		
Various societies by DSD	.543		.678	
Number of midwives per DSD	.916			
Communications Index	.811			
Road density		.413		.461

Figure 5 and tables 3 and 4 show the scree plot, factor loadings and the rotated component matrix for the Social Resources Index. Key components, such as literacy rate, access to education and healthcare facilities, exhibit significant positive correlations, while road density shows a moderate positive correlation. These findings highlight the complex interplay of various social elements in shaping the overall Social Resources Index. The resulting Vulnerability Index map for Social Resources is shown in Figure 6.

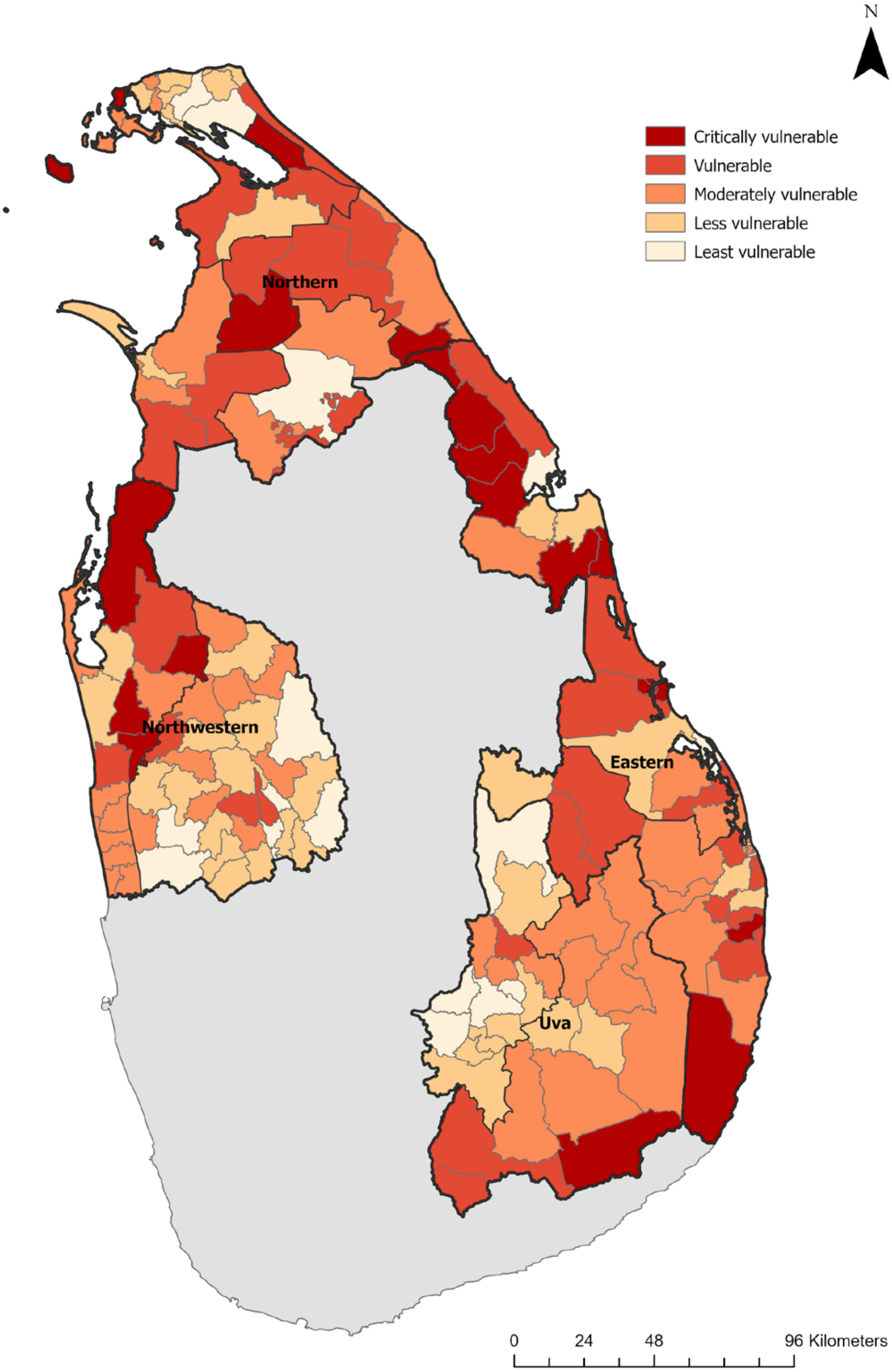

Figure 6. Social resources impact on climate and conflict vulnerability map.

4.1.3 Personal well-being impact on climate and conflict vulnerability

Personal Well-being Index

Figure 7 shows the scree plot which visually represents the significance of personal well-being indicators, while factor loading weights identify the contribution of each factor (Table 5). The rotated component matrix refines our understanding of the interplay between different personal well-being indicators, highlighting key factors that demand attention in policy formulation (Table 6).

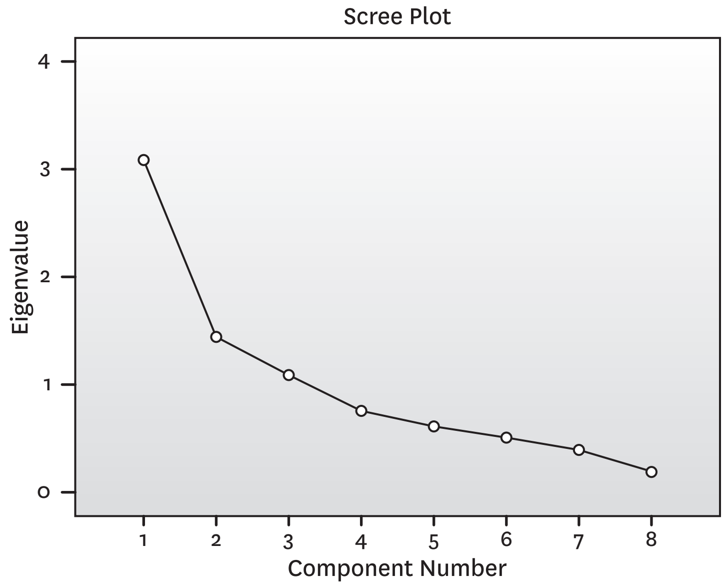

Figure 7. Scree plot for personal well-being indicators.

Table 5. Factor loading weights for personal well-being impact on climate and conflict vulnerability.

Component	Weight
1	53.65
2	26.41
3	19.94

Table 6. Factor loading values in rotated component matrix for personal well-being impact on climate and conflict vulnerability.

Rotated Component Matrix			
	Component (factors)		
	1	2	3
Access to shelter and housing (per capita housing unit)		.813	
Number (as a %) of people having access to safe drinking water	.439		-.667
Underweight %	.926		
Stunting %	.827		
Wasting %	.785		
Percentage of pregnant mothers with BMI < 18.5	.722		
Percentage of pregnant mothers with anemia			.704
Number of low-weight births reported		-.828	

Figure 7 and Tables 5 and 6 show the scree plot, factor loadings and the rotated component matrix which provides crucial insights into the factors influencing the Personal Well-being Index. Key components such as access to shelter and housing, nutritional health indicators and access to safe drinking water, exhibit significant positive correlations. Conversely, the number of low-weight births reported shows a significant negative correlation. These findings underscore the intricate interplay of various personal well-being elements in shaping the overall Personal Well-being Index. The resulting Vulnerability Index Map for Personal Well-being is shown in Figure 8.

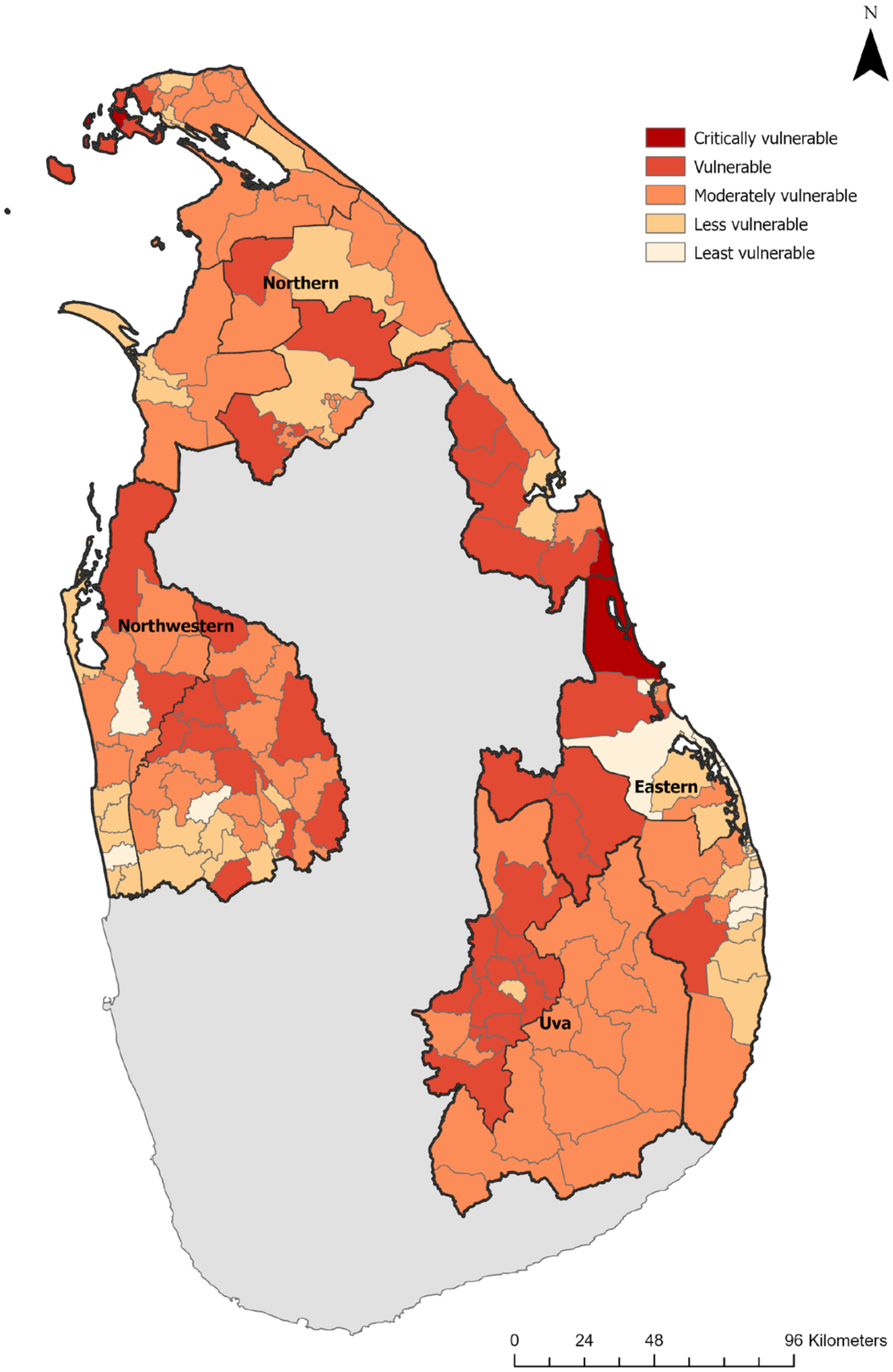

Figure 8. Personal well-being impact on climate and conflict vulnerability map.

4.1.4 Demographic factors impact on climate and conflict vulnerability

Demographic Factors Index

Figure 9 shows the scree plot which visually represents the significance of demographic indicators, while factor loading weights identify the contribution of each factor (Table 7). The rotated component matrix refines our understanding of the interplay between different demographic indicators, highlighting key factors that demand attention in policy formulation (Table 8).

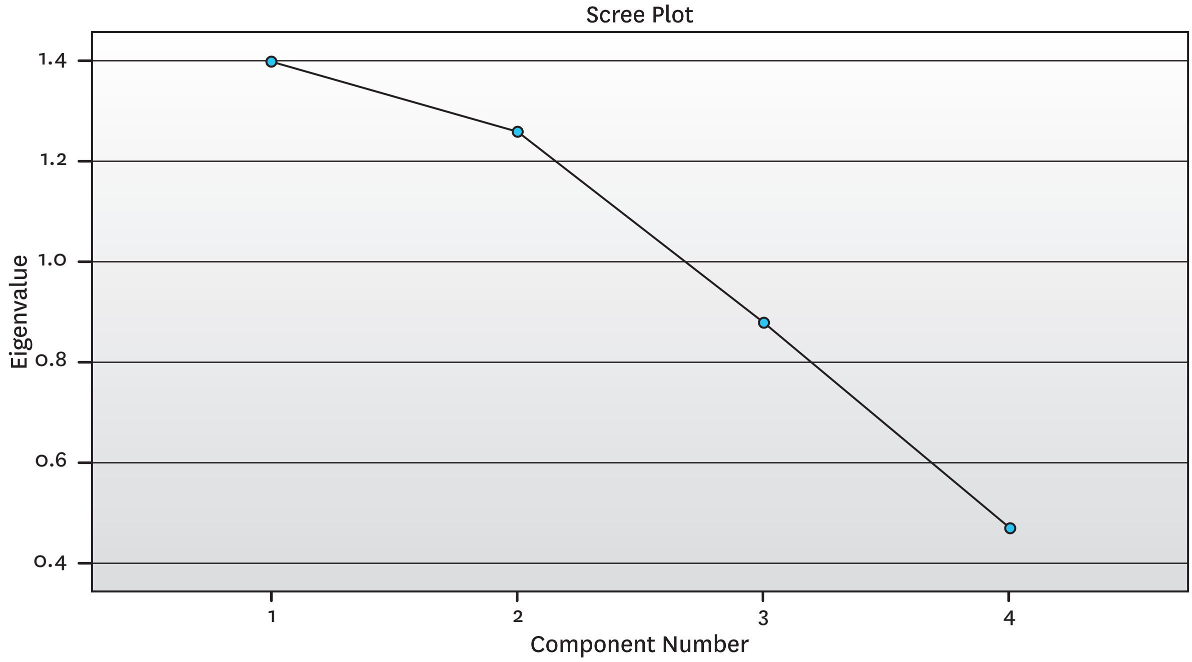

Figure 9. Scree plot for demographic indicators.

Table 7. Factor loading weights for demographic factors impact on climate and conflict vulnerability.

Component	Weight
1	52.63
2	47.37

Table 8. Factor loading values in rotated component matrix for demographic factors impact on climate and conflict vulnerability.

Rotated Component Matrix		
	Component (factors)	
	1	2
Population density		.788
Dependency ratio	.839	
Gender equality		.797
Population by ethnic group	.832	

Figure 9 and Tables 7 and 8 show the scree plot, factor loadings and the rotated component matrix for the Demographic Factors Index. Key components such as population density, dependency ratio, gender equality and population distribution by ethnic groups exhibit significant positive correlations. These findings highlight the complex interplay of various demographic elements in shaping the overall Demographic Factors Index. The resulting Vulnerability Index Map for Demographic Factors is shown in Figure 10.

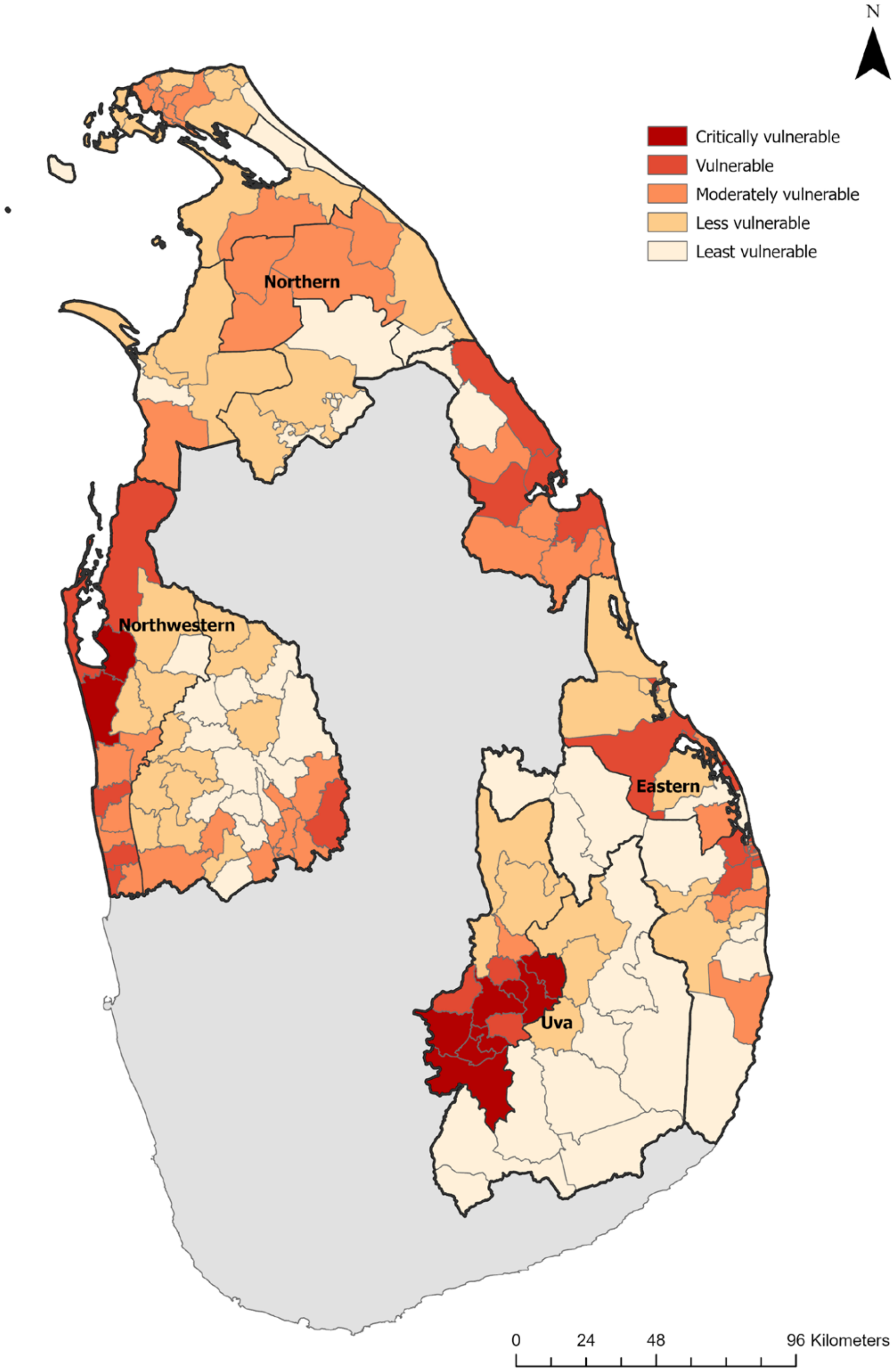

Figure 10. Demographic factors impact on climate and conflict vulnerability map.

4.1.5 Climate exposure impact on climate and conflict vulnerability

Climate Exposure Index

Figure 11 shows the scree plot which visually represents the significance of climate exposure indicators, while factor loading weights identify the contribution of each factor (Table 9). The rotated component matrix refines our understanding of the interplay between different climate exposure indicators, highlighting key factors that demand attention in policy formulation (Table 10).

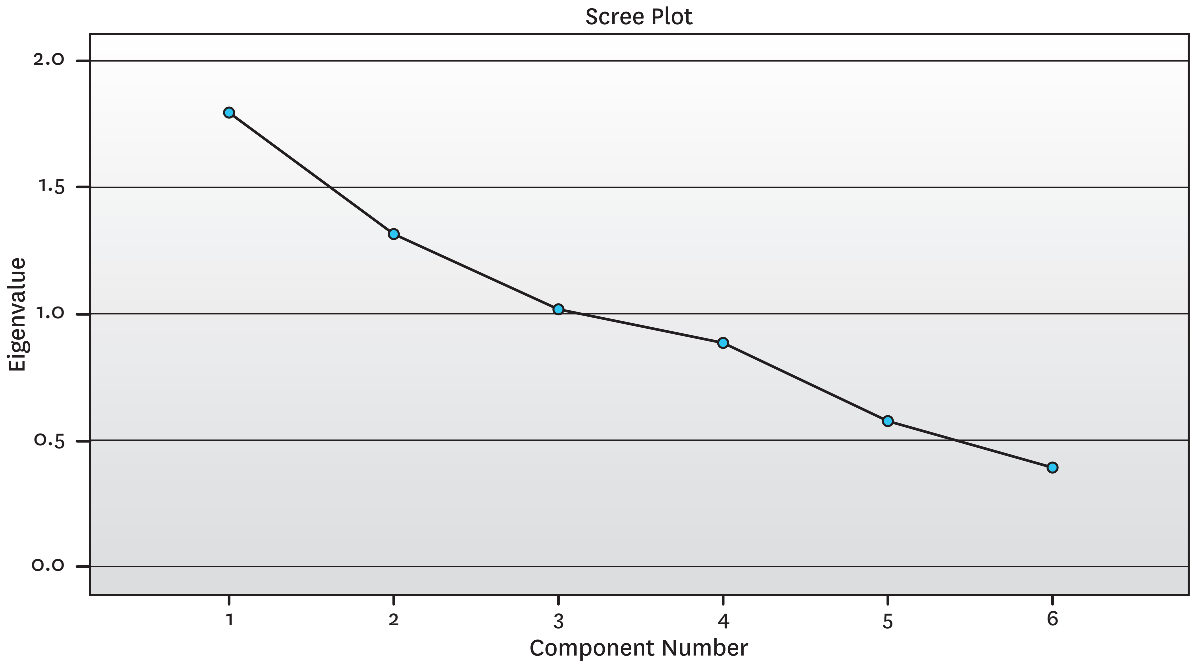

Figure 11. Scree plot for climate exposure indicators.

Table 9. Factor loading weights for climate exposure impact on climate and conflict vulnerability.

Component	Weight
1	42.41
2	29.15
3	28.44

Table 10. Factor loading values in rotated component matrix for climate exposure impact on climate and conflict vulnerability.

Rotated Component Matrix			
	Component (factors)		
	1	2	3
Exposure risk for wind		.697	
Exposure risk for cyclone	.837		
Exposure risk for drought			.891
Exposure risk for flood	.856		
Exposure risk for heavy rainfall		.746	
Exposure risk for landslide	-.458		-.597

Figure 11 and Tables 9 and 10 show the scree plot, factor loadings and the rotated component matrix for the Climate Exposure Index. Key components, such as exposure risks for different climate events, exhibit significant positive correlations. Notably, exposure risk for landslides shows a significant negative correlation. These findings underscore the intricate interplay of various climate exposure elements, in shaping the overall Climate Exposure Index. The resulting Vulnerability Index Map for Climate Exposure is shown in Figure 12.

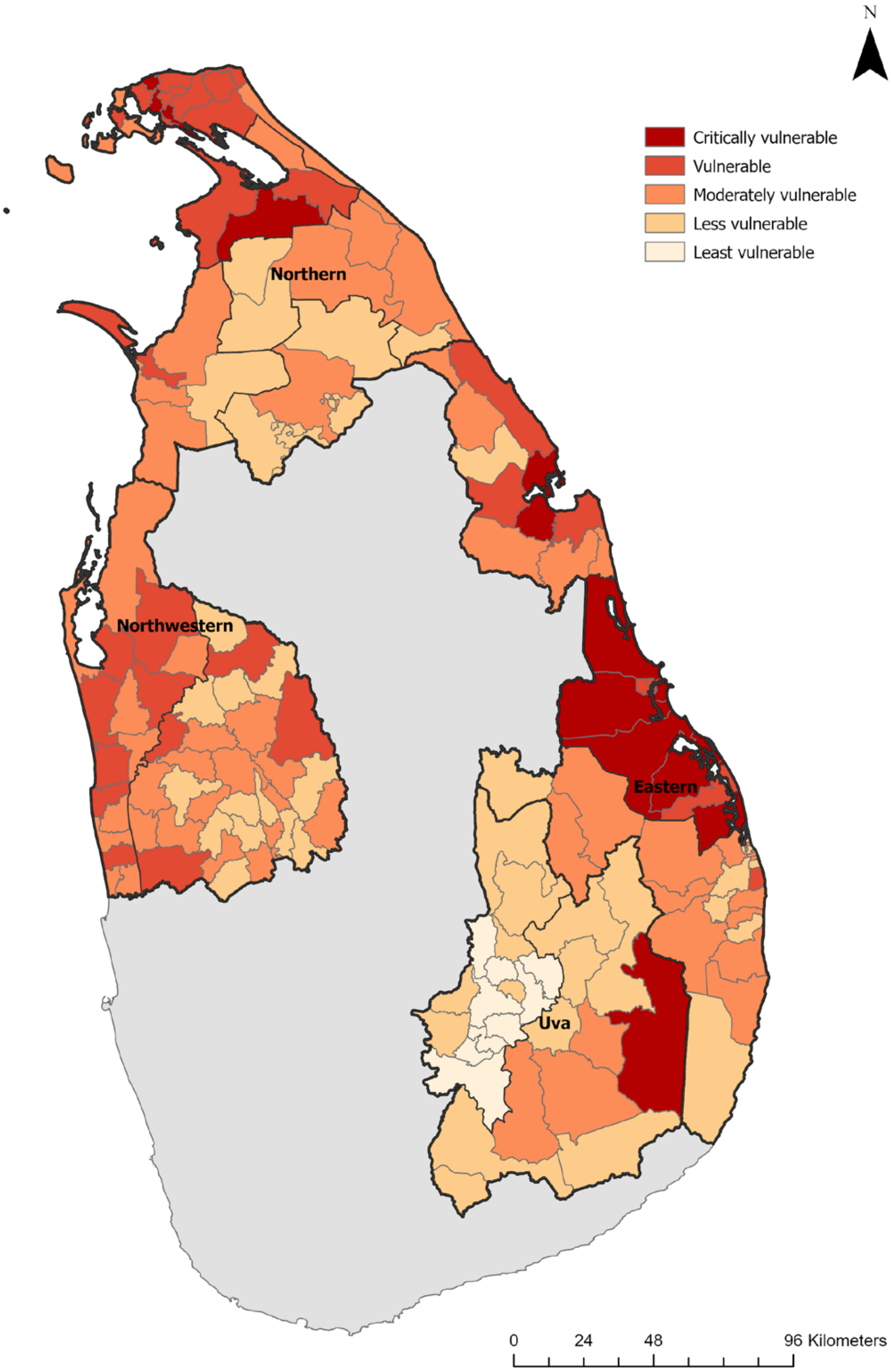

Figure 12. Climate exposure impact on climate and conflict vulnerability map.

4.1.6 Sensitivity drivers' impact on climate and conflict vulnerability

Sensitivity Drivers Index

Figure 13 shows the scree plot which visually represents the significance of climate exposure indicators, while factor loading weights identify the contribution of each factor (Table 11). The rotated component matrix refines our understanding of the interplay between different climate exposure indicators, highlighting key factors that demand attention in policy formulation (Table 12).

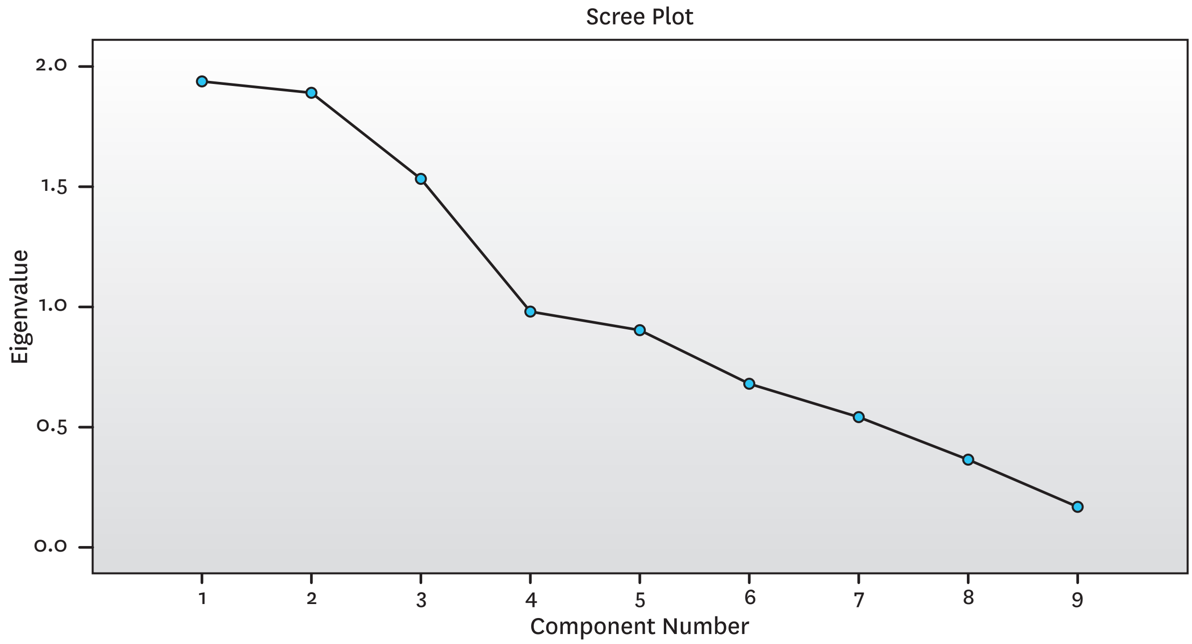

Figure 13. Scree plot for sensitivity indicators.

Table 11. Factor loading weights for sensitivity drivers' impact on climate and conflict vulnerability.

Component	Weight
1	35.19
2	33.05
3	31.76

Table 12. Factor loading values in rotated component matrix for climate sensitivity drivers' impact on climate and conflict vulnerability.

Rotated Component Matrix	Component (factors)		
	1	2	3
Estate population density			-.553
Percentage of paddy area served by major irrigation schemes		.763	-.451
Percentage of paddy area served by minor irrigation schemes	.808		
Percentage of paddy area rainfed		.909	
Rural population density			
Farm diversity (Crop Diversity Index – CDI)			.772
Agricultural operators (crop cultivators) by DS	.530		-.562
Agricultural operators (animal husbandry with aquaculture) by DS	.653		
History of conflict, war or violence	.578		.437

Figure 13 and Tables 11 and 12 show the scree plot, factor loadings and the rotated component matrix for Sensitivity Drivers Index. Key components such as agricultural practices, population density and the history of conflict, exhibit significant positive correlations. Notably, estate population density shows a significant negative correlation. These findings underscore the intricate interplay of various sensitivity driver elements in shaping the overall Vulnerability Index for Sensitivity Drivers. The resulting Vulnerability Index Map for Sensitivity Drivers is shown in Figure 14.

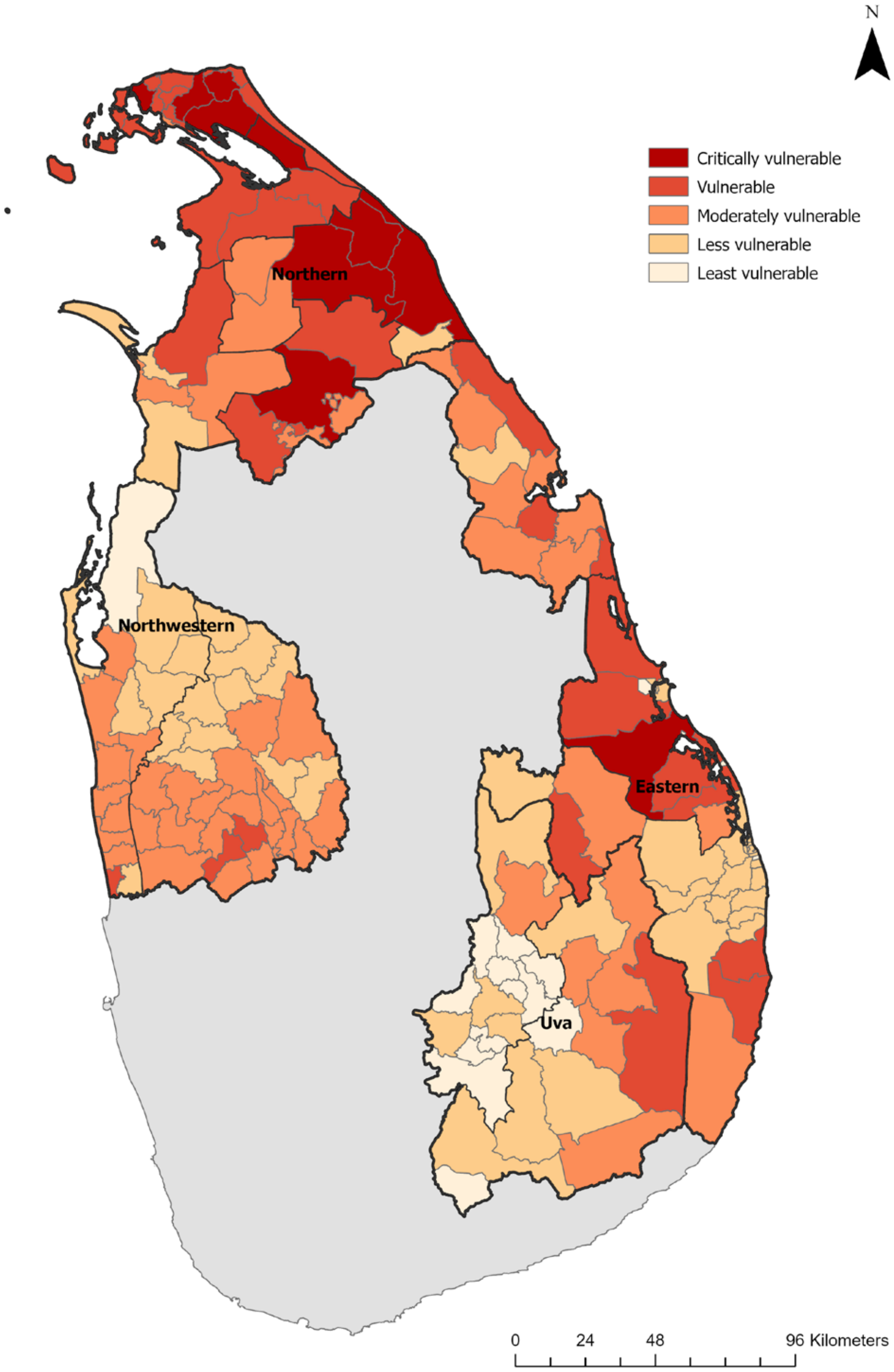

Figure 14. Sensitivity drivers' impact on climate and conflict vulnerability map.

4.2 Overall Climate and Conflict Vulnerability

Based on the results obtained for the six vulnerability indices mentioned above, a climate and conflict vulnerability map was developed using a weighted overlay technique. In the process of combining these six indices, no priority was assigned to any particular index, and equal weights were considered for each of the six indices. The resulting map obtained by integrating information from all six indices, is presented in Figure 15. This map provides a holistic representation of the overall climate and conflict vulnerability, considering the various dimensions captured by the individual indices in an equitable manner. The map highlights districts like Trincomalee, Jaffna and Puttalam as particularly more vulnerable than other districts.

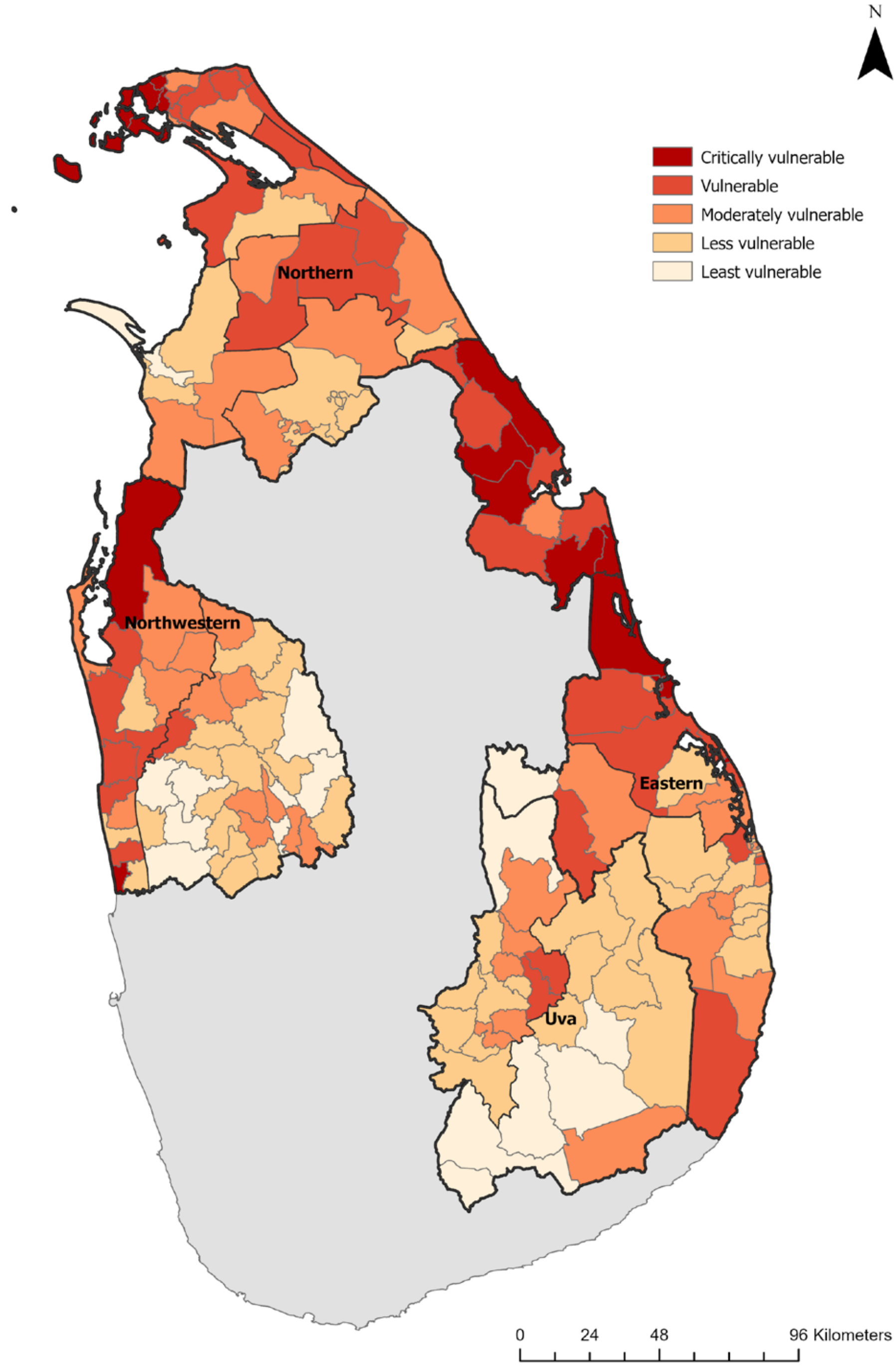

Figure 15. Overall climate and conflict vulnerability map.

4.3 Climate and Conflict Vulnerability Considering Only Drought Exposure

4.3.1 Climate exposure by considering only drought

When focusing solely on drought as a climate exposure factor, excluding other types of climate extremes, the resulting climate exposure map is illustrated in Figure 16. This specific map provides a targeted depiction of vulnerability related to drought, isolating its impact without the influence of other climate exposure variables.

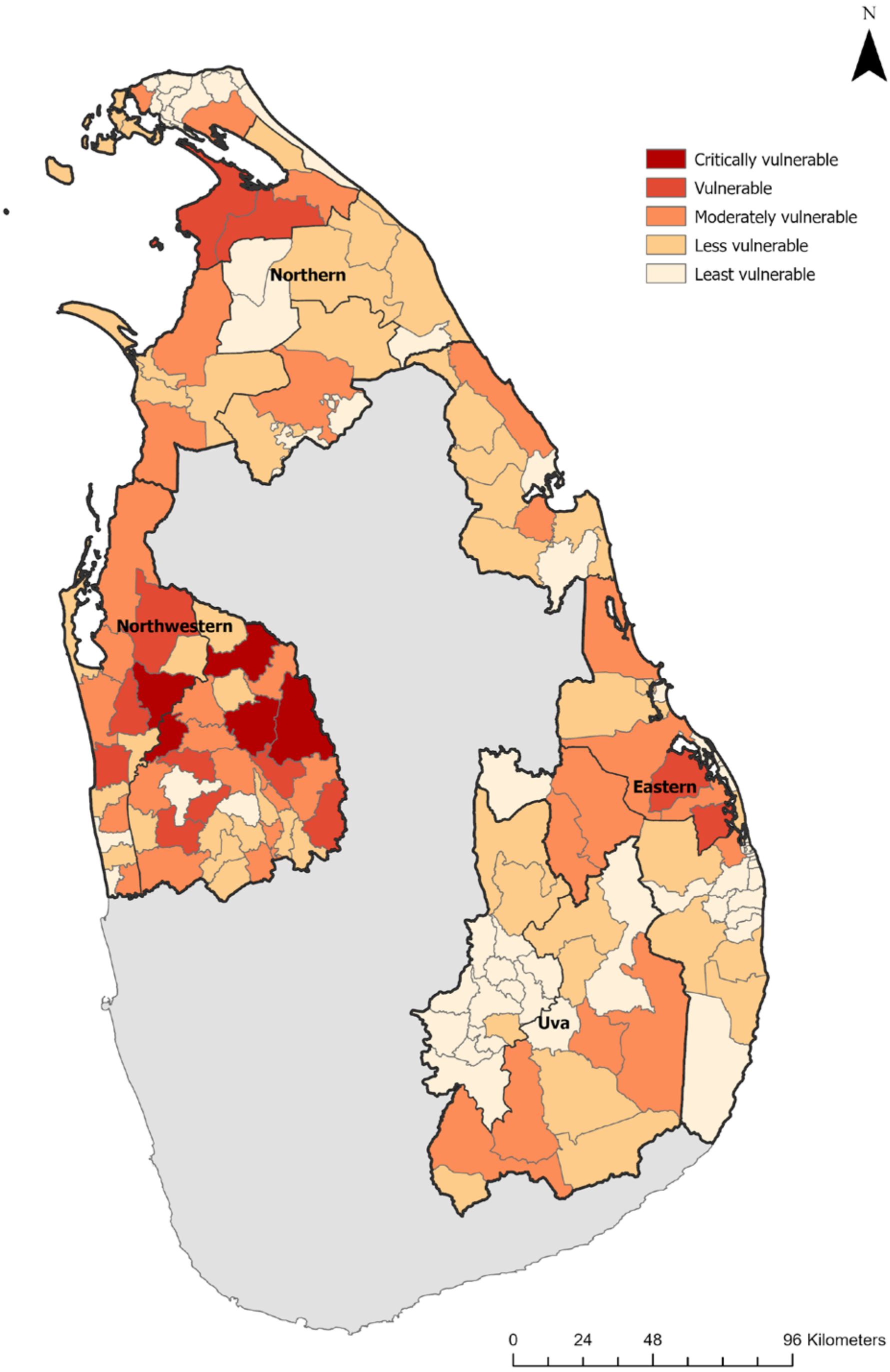

Figure 16. Climate exposure map by considering only drought.

4.3.2 Overall climate and conflict vulnerability map only considering drought exposure

When exclusively considering drought as a climate exposure factor and subsequently combining it with the other five factors associated with climate and conflict vulnerability, the resulting overall climate and conflict vulnerability map is depicted in Figure 17. This map offers a comprehensive visualization that integrates the specific impact of drought with the broader context of various climate and conflict vulnerability dimensions. The amalgamation of these factors provides a more nuanced understanding of the overall vulnerability landscape. When considering drought as a climate exposure, the Northwestern province has been highlighted. Therefore, Puttalam and parts of the Kurunegala district are becoming more vulnerable when drought is considered as a climate exposure.

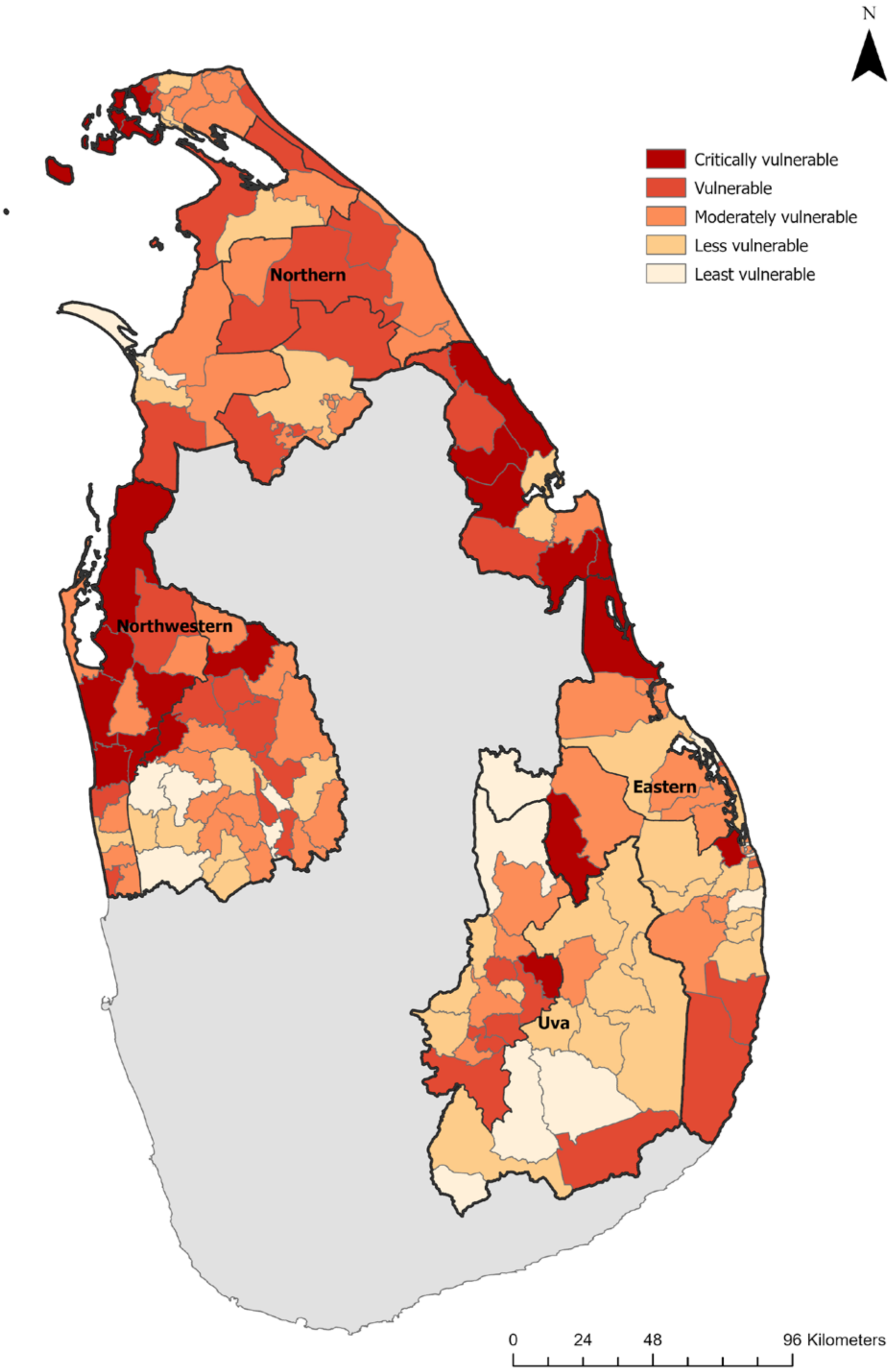

Figure 17. Overall climate and conflict vulnerability map (only considering drought exposure).

5. Validating the Maps Through Stakeholder Consultation for Identifying Climate-Conflict Hotspots to Focus On

The maps created using available secondary data were used by the project team to select potential focal districts and thereafter select two focal Divisional Secretariat Divisions (DSDs) within each DSD, where project investments could occur. As detailed below, once potential districts were selected by the team, this involved presenting and refining the maps for the selected districts through consultations with several government officials at district and divisional levels. This was done to minimize assumptions and build consensus on where the project should focus within each of the two selected districts, namely Puttalam in the Northwestern Province and Kilinochchi in the Northern Province. Given that the consultation methodology was similar in both districts, the process implemented in Puttalam is detailed in this section.

5.1 Selection of Puttalam District

In the overall climate and conflict vulnerability ranking by DSDs, the Trincomalee, Jaffna, Batticaloa and Puttalam Districts appeared within the list of top 20 highly vulnerable DSDs. As Chrysalis is currently involved with implementing a similar project with UNDP in the Batticaloa and Trincomalee districts, the consortium decided to avoid selecting sites in these two districts in order to avoid duplication. Therefore, the Northern and Northwestern Provinces remained as the project focus.

As a pilot intervention, the consortium decided to focus primarily on conflicts associated with exposure to drought and particular vulnerabilities around water and land resources, and its impacts on livelihoods. The mapping of overall climate and conflict vulnerability considering only drought as the climate exposure, provided insights into which DSDs within Puttalam were potentially highly vulnerable to drought-related conflict drivers.

An initial scoping visit to Puttalam district conducted on 1st March 2023, based on the first draft of the vulnerability maps, provided initial insights into livelihood vulnerabilities, types of conflicts and vulnerable DSDs. Based on the final version of the maps, the consortium team members came together to discuss a shortlist of potential DSDs informed by ground knowledge and information collected during the scoping visit. In consultation with the District Secretary, Anamaduwa, Arachchikattuwa, Mundalama, Kalpitiya and Karuwalagaswewa were shortlisted as potential DSDs from which to gather more data to select the final two intervention DSDs in the Puttalam District. The team was conscious of comparing primary data from the ground across DSDs that appear critically vulnerable (red) against moderately vulnerable (orange) in the mapping. The process of selecting the final two DSDs is described below.

5.2 Divisional Secretariat Divisions (DSDs) Selection Criteria and Tool Development

In order to select the appropriate DSDs, the Centre for Poverty Analysis (CEPA) developed a tool for selection based on the required criteria. The criteria for selection and the rationale are as follows.

1. **Exposure to climate change impacts:** Exposure to climate change and drought in particular, was an important factor to assess whether drought has a significant impact on communities and their livelihoods within the DSD and its potential as a driver of conflicts.

2. **Water source and quality:** This was included as a criterion to understand the competing uses of water sources for livelihoods and drinking. Any salinization issues and related causes were also important to understand vulnerability.
3. **Livelihood vulnerability:** Understanding agriculture practices and livelihood diversity would provide context on the vulnerability of the communities. Any practices followed to increase resilience to climate shocks would also be important to assess adaptive capacity.
4. **Access to services:** This is an important indicator of the socio-economic conditions, as the availability of services can increase a community's resilience to the impacts of climate change and the lack of it can increase the risk of conflict.
5. **Types of projects being implemented in the DSD:** The project is eager to reach the most vulnerable communities. The availability of other interventions in the DSD was important to avoid duplication, analyze where coordination and collaboration will be possible, as well as assess which DSDs had lesser funding and attention.
6. **Prevalence of conflict:** This criterion was used to gather whether there are any natural resource-based conflicts reported within the DSD, as the project is focused on addressing such conflicts.
7. **Practical considerations:** The final criterion was used internally to assist the team to consider the level of interest among local government officers and also logistical considerations for implementation.

5.3 Summary of Field Level Discussions and Selection of the Two Intervention DSDs

The consortium team visited Puttalam District from May 10th to 12th 2023 to present the methodology and key findings of the climate-conflict vulnerability mapping to selected District and Divisional Secretariat level officers and to gather detailed information on the climate change and conflict context in the shortlisted DSDs, towards making a final selection. The discussions with local level officers were held in two segments. The team first delivered an input presentation of the climate vulnerability mapping, including a brief explanation on the key indicators—economic capacity, social resources, personal well-being, demographic factors, climate exposure and sensitivity drivers—data sources, statistical techniques used and final maps. The officers' responses to the maps were recorded, as an important process in ground truthing the maps. Thereafter the team collected contextual information on the respective DSD guided by the selection criteria.

The local level stakeholders felt that in certain cases the maps did not present an accurate representation of the vulnerabilities in some of the DSDs. Water management and livelihood-related impacts of climate change were issues within the district. It was interesting to note that the stakeholders highlighted flooding as the foremost issue within the DSD. However, it was clear from the conversations that the floods were primarily due to unregulated infrastructure development. Competition for depleting water sources during the drought and its potential to trigger conflicts was also highlighted. The team also held a workshop with local level CSOs and activists from Puttalam, to obtain feedback on vulnerabilities within the district.

On May 15th 2023, the consortium team met the District Secretary and relevant senior officers to make a final selection. The climate and conflict vulnerability maps were presented to the District Secretary. Thereafter, the team presented a summary of the selection criteria and the data collected from the five shortlisted DSDs. Of the shortlisted DSDs, Anamaduwa showed greater issues related to climate change and conflict vulnerabilities and was therefore selected as the first intervention DSD. The District Secretary proposed that Mahakumbukadawala DSD be selected as the second site, since it is a highly vulnerable DSD in terms of drought and poverty, despite not being featured as such in the maps. After the meeting with the District Secretary, the team visited the Mahakumbukadawala District Secretariat and gathered data as per the selection criteria.

6. Conclusions

This study provides a systematic assessment of climate and conflict vulnerability in the Northern, Northwestern, Eastern and Uva provinces of Sri Lanka. By integrating economic, social, demographic, environmental and climatic factors, the Climate and Conflict Vulnerability Index offers valuable insights into the region's most susceptible to compounded risks. The findings highlight that vulnerabilities are driven not only by climate stressors such as drought and floods but also by socio-economic disparities and resource competition.

The results emphasize the importance of targeted interventions, to enhance resilience at the local level. Strengthening resource management, supporting economic diversification and improving access to essential services can help communities better withstand environmental and socio-economic challenges. The focused analysis in Puttalam district further demonstrates how data-driven approaches can inform strategic planning and prioritization of actions.

Going forward, continuous monitoring and adaptation of strategies will be necessary to address evolving vulnerabilities. Effective collaboration between policymakers, development organizations and local communities is essential in fostering stability and long-term sustainability in the regions studied. By integrating climate-sensitive planning with broader socio-economic considerations, Sri Lanka can strengthen its capacity to manage risks and build a more resilient future.

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