Farmer's Perception and Adaptation to Climate Change Impacts in Hakha Township, Chin State, Myanmar

Joseph Ceu Uk[11]

Abstract

Communities in Chin State are extremely vulnerable to climate change since both highland and lowland regions are exposed to it. Agriculture provides 90% of household income, and rural Chin families have traditionally relied on swidden agricultural production on marginal land to fulfill their food needs. They cultivate a small number of basic crops (usually millet and maize) with minimal inputs other than seed, human effort, and organic fertilizer. Aside from low profitability, insufficient diversification, and a significant reliance on loans, agricultural households face extra stress from soil erosion, irregular rainfall patterns, harsh temperatures, and commodity price volatility associated with climate change. In recent years, changing weather patterns and seasonal volatility have become a major barrier to crop production in Chin State's Hakha Township. This article examines how farmers view agricultural challenges caused by climate change, as well as the techniques they use to cope with and adapt their customary agricultural practices, using traditional knowledge. Based on household surveys and key informant interviews, I discuss how most farmers see climate change as a major impediment to their everyday livelihoods since they believe their agricultural productivity is significantly harmed, particularly by irregular rainfall.

1. Introduction

Myanmar is one of the most vulnerable countries to climate change, ranking second out of 187 countries in the Global Climate Risk Index (Eckstein et al., 2021). Chin State is one of the most affected by climate change, such as floods and droughts, which occur due to erratic rainfall and have immediate and devastating consequences. Many people in Chin State rely on farming to support their livelihood needs. Increasing temperatures and irregular rainfall induced by global carbon emissions jeopardize Chin people's capacity to retain their traditional livelihoods. On top of this, Myanmar is now experiencing a deepening civil war because of a military coup in February 2021, and the subsequent escalation of conflict has had a devastating impact on the people's ability to respond and cope with the effects of climate change. Since the coup, many farmers in Chin State have struggled to secure their livelihoods because of the state's ongoing war against the revolutionary forces. Climate change and conflict, therefore, intersect in Chin State, Myanmar, in a mutually reinforcing way. The violence undermines local livelihoods in multiple ways, while climate change worsens the situation by threatening food security. For Chin people, these vulnerabilities are compounded by insecure land tenure, as they rely on

[11] Faculty of Social Science, Chiang Mai University

customary land and forests for alternate food supplies and agricultural output. Climate change along with war exacerbate human insecurity among the poor and farmers.

Climate change is anticipated to have a detrimental influence on the four pillars of food security —availability, access, utilization, and stability—and their linkages (FAO et al., 2021). According to the IPCC (2023, p. 9) synthesis report, "Human-caused climate change is already impacting a wide range of weather and temperature extremes across the world resulting in broad negative repercussions on food and water security, human health, economics, and society, as well as associated losses and damages to environment and people. Vulnerable groups have historically contributed the least to present climate change and are disproportionately affected." In Chin State, people's vulnerability to climate change also intersects with issues related to the coup, including environmental degradation, and the climate change's effects on Hakha Township have become worse than in the past. More frequent landslides, the loss of farms and crops, health problems, a rise in temperature and insect infestations in crops and water shortages, and the devastation of homes, roads, and other infrastructure are all predicted effects of these climatic changes. Therefore, this paper discusses and examines how farmers in northern Chin State perceive climate change and its impact on their traditional livelihoods and agricultural productivity amid conflict.

2. Historical Background

Since Myanmar is placed second on the Global Climate Risk Index for its sensitivity to extreme weather events (MONREC, 2019, 2021), Chin state is one of the most affected by climate change, affecting its agriculture, fishing, and animal livelihoods (Hickey and Maria-Snub, 2022). Before the February 2021 coup, agriculture made a significant contribution to Myanmar's GDP. The International Work Group for Indigenous Affairs' Nikita Bulanin (2023) stated that "it is likely that Myanmar's forest cover and its biodiversity will continue to decline as long as armed conflict continues and there are no spaces for civil society, including indigenous peoples' organizations, to constructively engage with the government on issues around climate change and adaptation to it as well conservation." Chin State is home to about half a million people, mostly ethnic Chin, whose livelihoods have traditionally revolved around subsistence farming of a small number of staple crops on frequently deficient soil and steep slopes as well as opportunistic trading with lowland populations in the nearby valleys below (Institute of Chin Affair, 2023; Mark, 2016). Rural Chin households historically relied on swidden agricultural production on marginal land to meet their food needs, growing a small number of staple crops (typically millet and maize) with no inputs other than seed, human labor, and organic fertilizer (Boutry et al., 2018; Solidarities International, 2010). Chin's beliefs in Christianity place a high value on the environment because their livelihood is entirely dependent on it. For example, before engaging in shifting agriculture, they perform a sacrifice rite for their gods to request that their gods protect their crops from bug infestation and provide them with a good crop. The households' access to resources for making a living and to assets for securing a livelihood are both limited, and most of their produce is consumed by themselves rather than sold to others. Despite the Chin people's limited experience with commercial agriculture, centuries of human activity have degraded the region's woods and grasslands (Mark, 2016). The undulating topography and height of Chin State make it particularly

vulnerable to severe soil erosion and land degradation. Rural Chin people are severely affected by climate change, and traditional subsistence farming practices are becoming more susceptible to climate change.

Tin Yi (2012) states since 1977, the temperature and drought risks have increased, normal monsoon breaks became weaker and disappeared in the 1990s, and the monsoon depression became less significant in the 1980s and 1990. The annual rainfall quantity in Chin has a humid subtropical, dry winter climate. The city's annual temperature is 22.29ºC (72.12ºF), which is -4.73% lower than Myanmar's average. Chin receives an average of 140.73 millimeters (5.54 inches) of precipitation each year, with 172.16 wet days (47.17% of the time). In Hakha township, the weather reaches the highest at 29.4 ºC and the lowest at – 4.0 ºC. The country's susceptibility to environmental deterioration and climatic change has increased due to conflict and ongoing civil war. Ethnic minorities are particularly vulnerable to climate change "due to their resource-based livelihoods and the location of their homes in vulnerable environments" (Wildcat, 2013, p. 509), as well as poverty and marginalization (Ramos-Castillo et al., 2017). Food security and livelihoods in communities affected by war have been negatively impacted by the vital agricultural industry being damaged by rising violence and climate-related disasters since the military took power in 2021 (Norwegian Institute of International Affairs, 2024). Since daily livelihoods rely heavily on hydro-climatic conditions, agriculture is especially vulnerable to extreme weather events, rising temperatures, and precipitation changes (Tun Oo, 2018).

This research focuses on the perception of climate change's impact on farmers, using the notion of slow violence in Hakha township in Chin State. Hakha is known as the Capital of Chin State and all the state administration is in place – the headquarters of all offices are available. Hakha Township has a total population of 49,497 people (Census, 2014). Ground nuts, sesame, sunflower, sugarcane, maize, banana, and elephant foot yam are the major crops grown in Hakha Township. According to data from Hakha Township's meteorology department (2015-2017), the average rainfall in Hakha Township is 2,619 mm, with December having the lowest average rainfall at 0 mm. It also has a lower average temperature than regions below 1,500 meters. The average yearly temperature is 17°C, with January being the coldest month at 9.4°C and July being the warmest at 20.3°C. According to the Hakha meteorology department's study (average of 2015, 2016, and 2017), the rainy season lasts from mid-May to mid-October, when 94% of the average annual precipitation occurs. The vegetative cycle of crops planted by farmers on paddy terraces and shifting cultivation plots occurs during this season, which lasts from mid-October to mid-February. The winter season is the coldest time of year and the start of the dry season. It falls around the time of most yearly crop harvests. The study by the Myanmar Institute for Integrated Development (MIID, 2014) in northern Chin State showed that due to longer and hotter dry/hot seasons brought on by climate change, there is a greater risk of devastating loss of agriculture products and forest fires in the pine trees.

Figure 1: Chin state township map. Source: UNDP, Chin state's comprehensive 5 years development plan and annual planning 2016-2021.

Chin State was annexed by the British Empire in 1886 by the Chin Hills Regulation Act. In the 1940s and 1950s, rice was first introduced to people in Hakha but was only available to wealthy families. The cultivation of upland paddy was only permitted on the plots of wealthy nobles; lower classes had to travel to major townships to trade goods for rice or make purchases. Land within lopils (plots/fields) was part of a communal pool, or by customary law, noble households owned more land than was necessary for their household food consumption. On a section of the land owned by noble households, who are permitted to share the land under customary law, paddy terraces were constructed. Therefore, these areas were not available for other households to practice shifting cultivation anymore. The study on the social structure of the Chin Society by anthropologist F.K Lehman in the 1950s argued that "shifting cultivation and home gardens generally provided enough for the annual household consumption and that food shortages were rare" (Lehman, 1963, p. 58). However, when the Burmese military gained control of the Chin Hills in 1962, the agricultural landscape of Chin changed dramatically. Ne Win introduced the "Burmese Way to Socialism," which included a paddy quota system that had a significant

impact on farming communities and the "compulsory delivery system," in which each farmer was given a specific amount of paddy based on the size of his paddy holdings, yield per acre, family size (Boutry et al., 2018). In addition, Chin farmers were encouraged to migrate from swidden cultivation to permanent farming, a transition associated with rural development in Myanmar policy circles (Htike, 2017; Phyo, 2015). However, Chin people largely continued to follow the customary land governance system in which land was owned communally, and there was no private land in shifting cropping zones (Boutry et al., 2018).

The Chin people continue to live, for the most part, autonomously from the state, relying on local agriculture and customary systems for daily government. However, the coup and the subsequent fighting, which has engulfed much of Chin State, have dramatically altered people's livelihoods. The Chin people's food and livelihood security are in jeopardy due to both the coup and the growing consequences of climate change. Farmers in conflict-affected areas are unable to work and confront food security issues and the impacts of climate change. Following the coup, the Chin had the highest food insecurity rate, with 30% of families reporting no food in 2021, up from 9% in 2020. The situation of nutrition and food security in Myanmar was assessed using seven rounds of nationally representative household panel data collected between July 2024 and December 2021. Overall, Myanmar's nutrition and food security situations deteriorated between 2021 and 2024. The IFPRI survey (2024) revealed Between April and July 2024, more than 3% of families faced moderate to severe hunger, with the highest rates recorded in Chin (14.4 percent), Rakhine (8.0 percent), and Kayah (5.2 percent). The proportion of households with low food consumption increased from 9.4% in December 2021-February 2022 to 17.7% in April-June 2023 and 13.5% in April-July 2024. In April-July 2024, Kayah had the highest share (52.3%), followed by Chin (33.9%) and Shan (21.1%) (International Food Policy Research Institute, 2024). Farmers' agricultural concerns are influenced by their socioeconomic condition. This paper will look at the Chin people's traditional subsistence agricultural livelihoods and examine how they perceive and respond to the effects of climate change during conflict. After the coup in 2021, Chin state was transformed into a revolutionary war zone. The primary purpose of the Chin's arms was to oppose the military regime and establish the Federal Union. The civil war between the Chin armed groups, which is becoming worse every day in the state, has made it more difficult for people to adapt to climate change because many farmers have been forced to flee, leaving their fields and agricultural land vacant. As outlined below, this paper will focus on how farmers attempted to respond to climate change despite the immense challenges posed by the current political situation and rapidly evolving conflict.

3. Statement of the Research Problem and Justification

Climate change is a global environmental concern with a significant impact on agricultural output and some negative repercussions for humanity, including a direct impact on food security (Enete & Onyekuru, 2016). Climate change, including rising temperatures, will have a huge influence on the global economy (Ozturk, 2017; Fahad & Wang, 2020), causing soil degradation, famine, and food insecurity (Knox et al., 2012; Giri et al., 2021). Similarly, the IPCC warns that in conflict-affected countries, the effects are exacerbated and leaves limited room for response and adaptation. People's ability to cope with these changes is also directly

related to politics and local governance. Chin State serves as an example of the difficulties and strengths of the farmer's capacity to adapt to climate change in the face of conflict. The standards of individual farmers, such as their level of agricultural experience, can also have a significant impact on how people perceive and respond to climate change. Climate change impacts are more severe in poor regions due to low adaptive capacity (Bello et al., 2013; Song et al., 2022). Deforestation in Chin State has exacerbated climate

change and recurrent floods by increasing surface runoff and soil erosion caused by the loss of plant root systems, which act as a natural glue for the eroding ground (DVB, 2017). Customary farming livelihoods in Chin farmers are also threatened by state-level policies that view traditional shifting cultivation livelihoods negatively (Boutry et al., 2018). Kerkhoff and Sharma (2006) argue that shifting cultivation not only supports the livelihoods of ethnic minorities and the poor and marginalized communities but also contributes to biodiversity conservation and maintenance of agriculture and forest preservation. Szott, et al., (1999) and Mertz et al. (2009) argue shifting cultivation is a diversified livelihood system that is effective in the conservation of biodiversity and sustainable management of soil and water resources. Shifting cultivation is deeply ingrained in the local community life for the Chin people, both culturally and socially (Boutry et al., 2018; Mark, 2016). However, many agronomists and ecologists regard shifting agriculture as destructive to the forest and dangerous to the planet's future (Bahuchet & Betsch, 2012).

Farmers in Chin are unable to access farmlands due to landmines and explosive ordnance, and the junta military has imposed travel restrictions that have delayed and disrupted the flow of food supplies and trade, making adaptation more difficult for farmers. Sagaing and Magwe generate many agricultural items that are exported to the Chin people. However, farmers in various locations of Sagaing and Magwe are unable to cultivate their crops owing to the civil conflict (Frontier, 2023). The army's presence in Chin State increased dramatically from one to ten battalions in 1990, accompanied by massive loss of traditional lands and the flight of many Chins to India and other countries to avoid slave labor and other violations of their rights by the military (Human Rights Watch, 2009). The coup in 2021 exacerbated the impact of the civil war on the Chin people; thousands of houses were torched by the military regime, and thousands fled to Mizoram, India. A female Chin community leader reports that the impact of conflict on the climate has been worse than in past years, owing to the impact of airstrikes on the terrain and smoke from burning structures. Therefore, this study examines how farmers in Chin State perceive and respond to the effects of climate change during a civil conflict as well as the relationship between traditional shifting agriculture and local adaptability. As detailed below, this study uses qualitative research to investigate the Chin farmers' knowledge and perceptions of climate change, as well as the local methods they are using to respond to these changes.

4. Research Questions

1. What are the major factors impacting Chin people's reliance on shifting cultivation?

2. Do Chin farmers perceive shifting cultivation as a reliable source of food security as seasonal temperature and rainfall become less predictable?

3. How have changing temperatures and seasonal variability in Chin State impacted the farmers' reliance on subsistence farming for their livelihoods?

5. Research Objectives

1. To examine farmers' perceptions of climate variability and its impacts on customary livelihoods.

2. To determine the factors influencing farmers' awareness of climate change.

3. To examine farmers' adaptation strategies to climate change and the constraints in implementing them.

6. Literature Review

6. 1. Farmer's Perception of Climate Change

Climate change poses a significant threat to human security through various environmental changes, including coastal erosion, reduced precipitation, declining soil moisture, increased storm intensity, and species migration (McCarthy, Leary, Dokken, & White, 2001). Climate change has become one of the most important environmental influences on farmland degradation, with the potential to undermine household food security (Rasul, 2021; Fan & Rue, 2020; Harvey et al., 2018). Bates et al. (2008) state the prevalence of extreme climatic events and unpredictable rainfall patterns results in more frequent and severe droughts and floods. Global food insecurity has already increased, owing mostly to climate change (World Bank, 2022).

The Intergovernmental Panel on Climate Change (IPCC, 2014) has highlighted the severe impacts of climate change in Southeast Asia, including rising temperatures and altered precipitation patterns, particularly in low-income communities such as Chin (Hung et al., 2010). A recent study on climate risk in Myanmar predicts that the climate will fluctuate significantly in the coming decades and cause more disasters (Mi Mi Tun, 2022). In addition to rising temperatures, a shift from a bimodal to an unimodal pattern in the rainfall distribution has been seen, leading to shorter rainy seasons (105 days compared to 145 days) and a later start to the monsoon season (Lwin, 2010). Drought is regarded as the country's most serious natural hazard because of its impacts on property, assets, and livelihoods (Hickey & Maria-Snub, 2022).

Myanmar is also the country that suffered the most from extreme weather occurrences between 2000 and 2019, owing largely to the military government's disastrous mishandling of Cyclone Nargis in 2008 (Eckstein et al., 2021). A rise in individual catastrophes related to floods and cyclones has been observed recently across the country. For example, in May 2023 Cyclone Mocha wreaked havoc in Rakhaing and Chin States, destroying homes, religious structures, educational institutions, and people's fields (Mi Mi Tun, 2021; UNICEF 2023). In Chin State, for example, rainfall was 30% higher in the last seven days of July 2015 than in any other month in the previous 25 years, causing significant devastation from landslides. Farmers' attitudes toward climate risk have a significant impact on how they manage climate-related risks and opportunities, and the specifics of their behavioral reactions to these attitudes

influence the available adaptation options, process involved, and results of the adaptation (Adager et al., 2009). If farmers do not perceive climate change as a significant threat, they are more unlikely to undertake adaptive actions (Arbuckle et al., 2015). Yarzar Hein and Kampanat Vijitsrikamol (2019) studied irrigated and rain-fed agricultural households in Myanmar and found that 85% of farmers perceived climate change as changing rainfall and temperature trends.

It has been described in numerous instances that farmers are aware of and able to observe long-term changes to rainfall patterns and temperature in their daily lives (Ndamani & Watanabe, 2015; Kusakari et al., 2014). Farmers are motivated to respond to climate change, take precautions based on their experiences, knowledge, and perceptions of extreme climatic occurrences and their effects, and decide whether to adopt adaptation strategies (Siegrist & Gutscher, 2008; Kreibich, Müller, & Merz, 2007). Colson and Raffaelli (2014) argue farmers' perceptions of climate change are crucial to their farm management, particularly in terms of risk perception, as they noted that farmers who understood climate change were aware of its negative effects and could anticipate long-term agricultural risk related to it. Climate change perception is strongly related to the degree to which climate-induced risks and opportunities affect the farmers and their livelihoods, and their responses and adaptation strategies are based on perception (Ndamani & Watanabe, 2015). The local perception and observations may also reflect real climate change impacts (Laidler, 2006) as well as regional concerns (Danielsen, Burgess, & Balmford, 2005). Farmers' perceptions of change are also influenced by their exposure, resilience, and adaptive skills (Ndamani & Watanabe, 2015).

A study conducted in Vietnam and Thailand by Hermann Waibel and Thi Hoa Pahlisch (2013) highlights that farmers recognize climate change, yet their characterizations differ based on geographic factors. For example, in Vietnam, perceptions are shaped by individual characteristics, regional variables, and recent climatic events. In contrast, there is notable variation in how farmers in Vietnam, Laos, and Cambodia perceive and respond to climate impacts. In Cambodia, a study by Venkatappa, Sasaki, Han, and Abe (2021) found that the country experienced the highest frequency of severe droughts between 2015 and 2019. Vietnamese farmers in group discussions reported severe droughts and heat waves in 2021, indicating an increase in the prevalence of climate hazards. Indigenous communities viewed the retreat of glaciers as a sign of divine retribution rather than environmental change (Allison, 2015). Similarly, in the Andes, fluctuations in temperature are seen as the wrath of the mountain deity 'Mama Cotacachi' (Rhodes, Zapata, & Aragundy, 2008). For some communities, disasters such as flooding and drought are also interpreted as results of the sins of people and disrespect to God (Kusakari et al., 2014). For example, smallholder farmers in Ethiopia considered climate change to be a direct result of humanity's punishment due to disobedience and unfaithfulness to God's rules (Debela et al., 2015). The poor, particularly those in developing countries, are projected to be disproportionately affected by climatic variability and change, necessitating the most effective adaptation techniques. In some countries, farmers are adapting to climate change by altering crop combinations and implementing new technologies in response to changing climate and economic conditions (Molua & Lambi, 2006). However, there is a growing body of knowledge that highlights the importance of traditional agricultural practices in response to climate change. Below, I outline

studies of shifting cultivation, an agricultural practice that is widely practiced among the Chin people of Myanmar.

6.2. Shifting Cultivation Practices

Research from other parts of the world demonstrates the importance of traditional Indigenous agricultural practices to respond to climate change, Throughout Southeast Asia, swidden agriculture remains a substantial source of local livelihoods and food security (C. Erni, 2015). Shifting cultivation is practiced by most people living in rural upland areas in Myanmar, which is crucial for their food security and livelihood, according to estimates of the area of land used for shifting agriculture (Boutry et al., 2018; POINT, 2015). While it is now widely recognized that shifting cultivation, when well-managed, can be beneficial to both communities and the environment, it had been seen as environmentally destructive for decades before (Cairns, 2015; Choudhury, 2021). Indeed, the Myanmar Forest Policy (MFP) of (1995) includes a directive to "discourage shifting cultivation practices that cause extensive damage to the forests by adopting improved practices for better food production and quality of life for shifting cultivators." It is a common misconception that shifting cultivation is the primary cause of deforestation. Shifting cultivation is not the main cause for deforestation because throughout the fallow period all fallow lands are replanted with trees and sufficiently regenerated to allow for subsequent cutting about seven or eight years later. Instead, logging, road construction, the creation of industrial zones, and dam construction significantly contribute more to deforestation. Lori Ann Thrup et al. (2007) argue that the Myanmar government should recognize the diversity, rights, culture, and traditional knowledge of shifting agriculture, as well as leverage the important experience and knowledge of Indigenous communities in carrying out development programs. Boutry et al. (2018) argue that the advantages of preserving indigenous agricultural methods, such as shifting cultivation, could also lessen the consequences of climate change.

In Burmese, shifting cultivation is called "*shwe pyaung taung ya*" which means "moving hill farm," or (hill farm). Shifting cultivation is a traditional form of agriculture often associated with Indigenous and ethnic minority communities in Myanmar, in which plots of land are cultivated and then left to regenerate in subsequent years by leaving the fields fallow for long periods (5-10 years). Shifting cultivation is the predominant agricultural system in upland areas of Chin State. Derek A. Smith argues that paddy and other crops grown through shifting agriculture benefit the ecosystem and wild environments, and also provide food for the animals (Smith, 2005). Similarly, Ngan Tang Gun argues Myanmar's shifting farming technique is not harmful to the environment but benefits it because, during the shifting cultivation harvest season, a variety of jungle birds and wild animals enjoy eating the abundant crops (Ngan Tang Gun, 2009). Indeed, shifting cultivation is "an ideal solution for agriculture in the humid tropics as long as the human population density is not too high and fallow periods are long enough to restore soil fertility" (Erni, 2015, p. 8). Shifting agriculture also conserves crop diversity and improves adaptability by producing a diverse range of food all year round, as well as a healthy diet rich in micronutrients, allowing one to meet all food security criteria at the same time. Additionally, shifting agriculture does not significantly contribute to deforestation when it is administered according to a customary system (Cowan, 2015). Villages with better land

management techniques, higher decision-making abilities, agricultural diversification, and good market access had better adaptability to climate change. In conclusion, shifting agriculture plays a vital role in the survival of ethnic culture, heritage, religious beliefs, and the livelihoods of nature-oriented hill farmers.

Most of the countries in Asia, such as India, Bangladesh, Bhutan, Nepal, and Myanmar recognize shifting cultivation as unproductive and harmful to the environment (Kerkhoff & Sharma, 2006). They perceive shifting cultivation as illegal and as the main cause for deforestation and climate change. These policies and actions by governments that cause forcible population displacements without their consent infringe on human rights to land. Indeed, many indigenous tribes wish to settle in their traditional and ancestral locations while responsibly managing the rich local and natural resources. Dispossession of their ancestral lands and restriction of access to forests and other natural resources, such as shifting agriculture, are some of the primary causes of poverty. They argue that many ethnic minorities and indigenous groups are ascribed negative attributes, including being described as primitive, backward, disloyal to national sovereignty and security, a hindrance to national progress, and so on (IWGIA, AIPP, & IKAP, 2009). Shifting farming is a land use form that upland peoples have used sustainably for millennia to meet their food needs while also preserving biodiversity as part of their cultures and way of life, which is inextricably related to their traditions, lifestyles, and livelihoods. IWGIA, AIPP & IKAP examined deforestation and found that agricultural intensification as well as small-scale and large-scale forest conversion into industrial plantations are the causes of carbon emissions. On the other hand, shifting cultivation is self-regenerating.

Despite the diversity of cultures and lifestyles, many indigenous peoples in Asia have close relationships with their lands and practice shifting cultivation to produce enough food for self-sufficiency, promoting food security. Like other Indigenous peoples, the Chins regard shifting agriculture as a means to ensure their food security and livelihood (Boutry et al., 2018; Mark, 2016). In the Chin setting, spatial structure of shifting cultivation at the village level is also embedded in strong communal social ties. Every household in the village that participates in the shifting cropping cycle cultivates the same *lopils* (plot). Rotational ginger fields, permanent vegetable gardens, and fruit orchards (mangoes, strawberries, bananas, citrus) are all included. All the plots are privately owned, the villagers share the plots in the village meeting, and they manage the land communally. Each village is made up of several clans, and clans share land among themselves and share other plots with families of other clans even outside the village (Hung Mana, 2014). It is customary within the Chin community for farmers to perform shifting cultivation on previously fallowed land to acquire access to the land for a certain purpose. However, since the colonial period, shifting cultivation has been perceived by the state as an "unproductive" form of agriculture that destroys forests (Bryant, 2009). As a result, unsustainable resource-use practices are becoming more common and are adding pressure on resources, thus threatening the very basis of their livelihoods.

7. Research Methodology

7.1. Conceptual Framework

This study examines the traditional agricultural practices of the Chin people, who have shared land for farming for the majority of their forefather's lifetime. The first argument aims to assess the influence of climate change on farmer livelihoods in terms of crop production by comparing the past to the present, as well as how they have managed it by changing plants, seeds, or cultivation methods. It also explores how the Chin people have adapted to climate change and their perception of it as well as how climate change has affected their way of living and agriculture, all within the framework of Myanmar's recent civil conflict. The key point here is the struggle against climate change and its influence in the midst of the state's conflict and civil war. Moreover, farmers are confronted with many risks and difficulties when managing their fields and security. Apart from assessing the impact of temperature and seasonal variability on the ability of Chin farmers to secure their food livelihoods from subsistence farming, the research examines the perceptions of Chin farmers regarding the effects of climate change, including reduced soil fertility, erratic precipitation, and scarcity of crop water. Finally, this paper explores how the Chin people's ability to respond to climate change is deeply impacted not only by the current civil conflict but also by decades of persecution and state-led structural violence (see Figure 2).

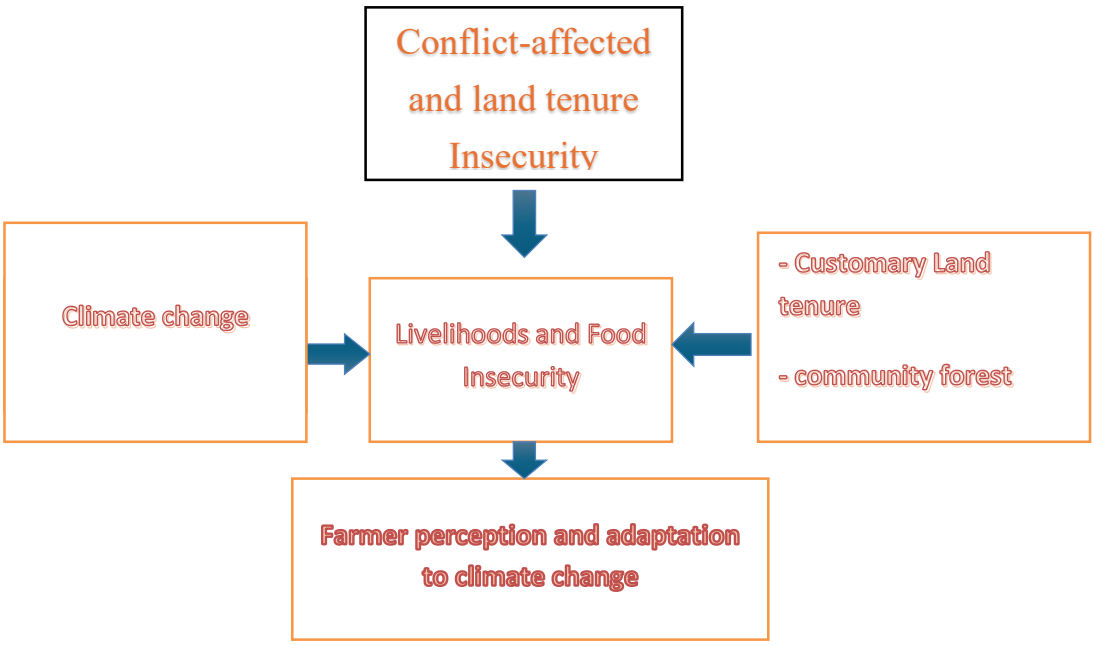

Figure 2: Conceptual framework

7.2. Site Selection

This study focuses on Hakha Township in Chin State, which is regarded as one of the most affected by climate change. Furthermore, there hasn't been much research into the effects of climate change on Hakha and their traditional techniques of shifting farming. This is owing, in part, to decades of military control that limited scholars' access to the country, particularly in ethnically conflict-ridden regions. Access to research increased during the reform period

(2011-21); but following the 2021 military coup, Chin State became even more inaccessible. Due to the ongoing civil war between the revolutionary forces and Myanmar's military, road conditions worsened, and significant security risks increased for tourists. The Chin community were displaced due to the fighting and lacked access to education, healthcare, and other means of subsistence, making them vulnerable to climate change.

7.3. Research Site

The study was done in regions of the Hakha Township in northern Chin State, which is one of the most sensitive areas to climate change and has long suffered from the unpredictable rain and changing temperature (Figure 3, Hakha town map). This study aims to explore how Chin farmers perceive climate change, as well as how climate change affects their livelihoods, particularly during this civil war. It also investigates climatic variability and climate change in Hakha Township, considering that the bulk of the residents have traditionally relied on shifting cultivation farming techniques as their primary source of income. Due to travel limitations and security concerns for both the respondents and the researcher, who is situated in an unsafe environment, the precise locations of the places are not indicated on the map. Semi-structured interview questions were prepared in English and translated into the local dialect. In addition, farmers in Hakha township were asked follow-up questions via social media platforms like Zoom, Messenger, Viber, and Signal.

Most Hakha township dwellers are known as the *"lai"* tribe among the Chin, and agriculture is their primary source of income. (See Fig. 3, Hakha township map). In the villages where the study took place, there are several species of wild creatures, including deer, bears, wild pigs, rabbits, foxes, monkeys, and serows, which are common in the area. Hakha also has a diverse bird population, and many people continue to hunt wild animals and fish in the waterways for their food and livelihood needs. The forests contain rich timber species such as mountain teak and pine. There is wild bamboo, cultivated bamboo, and other trees suitable for construction. The woodland is abundant in orchids and wild yams. Yam is cultivated in the hamlet as a cash crop, and it has recently become the village's main source of revenue. Many people in this area rely on agriculture for their livelihood despite the challenges presented by climate change since they have no other means of subsistence. All the villagers continue to practice shifting agriculture, and they are well-versed in land use, including the location and properties of various shifting cultivation regions, forest areas, and watershed areas.

Village A is located in the lowlands of Hakha township. The village has approximately 35 households. Most of the villagers' income and livelihood come from agriculture, including growing seasonal crops like grapes, parsley, and bananas - which they primarily sell in the market. Before the landslide in 2015, most villagers relied on paddy cultivation for their income and survival; however, the landslide destroyed all the paddy fields near the riverbank. While some farmers were able to relocate their rice fields (within the former village land), climate change and rain irregularities influenced paddy output since they were unable to plant on time, resulting in the decline of production. Another difficulty for village A was the impact of a military takeover in 2021, which prevented them from going to town to sell their products at the market. People in Village A have also been impacted long-term by conflict and violence. Many people described feeling stuck in the middle of the Chin revolutionary forces and the

military - the villagers have experienced extortion from both sides. As a result of their affiliation with the revolutionary forces, the villagers experienced torture and human rights abuses from the 1990s onwards. However, as the country opened, Chin lands became exposed to land grabs in the form of foreign investment and development. These dynamics all impacted the people's livelihoods and land tenure security.

Village B is in the hills, which has a significant impact on water scarcity. The community includes about 35 households. Strawberries (for sale) and other vegetables cultivated for home consumption are the most common agricultural operations. Before strawberry farming, the locals relied heavily on charcoal manufacture, which was required to consume trees. Only 2-3 families depended on paddy farming because the ground was steep and unsuitable there. In comparison to Village A, the 2015 landslide had a less severe impact, but the military coup in 2021 made it impossible for farmers to travel to Hakha to sell their strawberries. Most households rely on remittances. However, remittances are insufficient to meet their food and livelihood requirements, and many people rely on subsistence cultivation for food.

Figure 3: Hakha town Map. Source: Google map

7.4. Data Collection

Twenty farmers (ten female and twenty male) aged 40 to 66 years old who work in agriculture and have been affected by climate change due to increased temperatures and erratic rainfall in their region were questioned. Due to the insecurity in Myanmar, the researcher was unable to personally attend the research location; thus, an assistant helped conduct the interview. Interviewees were questioned about their views on climate change, its implications on agricultural commodities, and their personal experiences with it. The questionnaire was prepared and discussed with the research assistant in November 2023, as well as with members of a research team based in Denmark, Myanmar, and Thailand. The data-collecting period ran from December 10, 2023, to February 15, 2024. However, the field assistant was not able to collect data continuously due to travel limitations and frequent cut-offs of internet connection

by the military. Semi-structured interviews serve as the main means of collecting data. Interviewees were guided through the main research questions using semi-structured interviews. The research also adheres to the protocols of a comprehensive case study, which aids in comprehending the households' living conditions; perceptions and emotions regarding the impact of climate change on their agricultural production; their management practices for their cultivation plot; their historical uses of their forest, land, and natural resources; and their awareness of the consequences of climate change on their way of life and their emotional response regarding its impact. Key informants' interviews were also conducted with village elders who had long engaged in or practiced shifting cultivation farming. The researcher and assistant communicated over Viber and interviews were sent to the researcher via voice note, which were subsequently transcribed and translated from the Hakha Chin language into English. Consequently, after gathering data, the researcher analyzed the data and held some follow-up interviews.

7.5. Secondary Data

Secondary data on the "impacts of Climate Change, yearly temperature, and rainfall record" was gathered from online and offline sources, including the Department of Meteorology and Hydrology in Hakha. Additionally, information was gathered from local media and research undertaken by non-governmental organizations (NGOs) and Civil Society Organizations (CSOs) that are actively concerned with environmental issues.

7.6. Security and Ethics

Due to current political conflicts in Myanmar, particularly in the research location, the interviewees' biographies and backgrounds are not provided for security reasons. As a result, respondents and study regions are identified using pseudonyms. In addition, the exact area of the villages is not mentioned. The researcher and research assistant took significant care throughout the research process to secure the privacy and safety of participants. Initially, the researcher planned to go to Chin State to conduct the interviews in person in November 2023. However, the road that connects Hakha to Sagaing region was closed by the Chin army due to the conflict with the Myanmar military. As a result, data gathering was carried out from beginning to end with the help of an assistant.

8. Findings

Farmers have viewed rising temperatures, floods/landslides, droughts, and irregular rains as unproductive harvests. Landslides and natural catastrophes were particularly noted following uninterrupted rain in 2015. Farmers believe that after the 2015 tragedy, landslides and floods occurred every rainy season. Landslides are one of the most significant issues that Chin farmers confront in terms of agricultural effect. The increase in temperature is one of the facts most farmers perceived, and among the interviewees, 99% mentioned the temperature was warmer compared to the last two decades. For example, there was a lot of snow in the 2000s. However, farmers responded that they don't experience snow anymore, and it has become so warm that the farmers cannot even grow certain kinds of plants due to the heat. They noticed there had been a decrease in the number of rainy days, increase in the number of hot days, increase in

heat temperature, and a decline in the number of chilly days. Based on the interviews conducted, farmers in the study regions felt that the most significant difficulty facing them was the unpredictable rainfall. In the past, people could produce crops on time and maintain their livelihood and food security since the rains were consistent. Another observation was that water sources were drying up, which is affecting their paddy fields as well as cropland for irrigation.

Farmers have modified their agricultural operations in reaction to perceived changes. Traditional agricultural processes are being transformed into garden cultivation. Farmers choosing revenue crops are focusing on cultivating vegetables rather than maize and millet and converting highland farming into wine, *kamphe* (coriander), and strawberry gardens. Also, limestone mining is replacing charcoal production. More scientific investigation should look into hill farmers' agricultural diversification strategies. Crop diversity can increase production while improving ecosystem sustainability. Shifting agriculture, an age-old tradition, is vital to preserving ethnic culture, heritage, religious beliefs, and the livelihoods of nature-loving hill farmers. It also promotes ecological balance and deepens the relationship between community, environment, and development.

Climate change is affecting water resources and agricultural output in the Chin region, as can be seen in their water supply and the commencement and duration of various seasons. It is clear these variations are affecting their lives and livelihoods. The findings show that farmers' perceptions align with the rising annual and summer temperatures. However, their perceptions contradict the observed trends in the winter temperatures, as well as yearly, monsoon, and winter precipitation. Furthermore, farmers are increasingly experiencing extreme weather occurrences such as rainfall, floods, landslides, and droughts. These hazards have a negative influence on income and worsen the economic situation for subsistence farmers. Integrating farmers' opinions with hydrometeorological observations improves climate change impact assessment and informs mitigation and adaptation efforts.

9. Conclusion and Discussion

This study explored farmers' perceptions and responses to climate change in Hakha township of Chin State. The result found that the farmers in the local areas have observed climate change and its impact on them. There has been little research done in Chin due to the hardship of transportation. This research focuses on the social, economic, and ecological elements of communities affected by changing agriculture. Traditional shifting agriculture confronts sustainability challenges due to diminishing land holdings and shorter fallow seasons, which has posed a significant danger to the practice's ecological balance. According to the responders, it is apparent that the coup has created new obstacles to climate change. The many outside organizations that previously helped the farmers have abandoned their programs. As a result, it has been difficult for them to achieve climate adaptation. Farmers face increased food insecurity since they cannot access their crops easily. Farmers in the study areas responded that it has become hotter than before because there is no organization or government taking steps to protect the environment. 98% of farmers in the surveyed regions believe that climate change, particularly temperature increases, has caused the village to lose snow in comparison to previous years. One of the issues for Chin farmers since they mostly grow in mountainous

terrain has been water shortages, causing streams to dry up and forcing farmers to rely on irrigation for their crops. This has resulted in food insecurity and poverty. Furthermore, landslides have been regularly occurring and destroying their crops before they can be harvested, and the cultivated field has decreased due to natural disasters. Farmers have reported a rise in temperature, pests/diseases, flood/landslides, and drought, as well as a drop in rainfall and production compared to previous years of farming.

The majority of farmers have observed a decrease in the number of wet days, an increase in the number of hot days, an increase in summer heat, and a decrease in the number of cold days. This might be attributed to the reliance on rice as a primary crop, which requires seasonal rain for growing. Farmers anticipate conflicts over land and water resources, as well as issues with food security, as a result of these changes. Farmers have limited resources and capabilities; thus, they have only implemented feasible adaptation strategies. The adaptation options, which were selected for coping with climate pressure on their farming, included soil conservation, crop diversification, and irrigation techniques. Some of the farmers adapted by changing their crops, for example, planting more vegetables than maize to make more cash crops. The farmers' adaptation differs from each village and their adaptation depends on the temperature and geographical location of the villages.

References

Bar Bon, W. J., Myae, S. M. N., & Gonsalves, J. (2020). Nurturing adaptation capacities in Chin highlands: Lesson from Sakta: A Climate Smart Village in Myanmar. *International Institute of Rural Reconstruction*.

Chan, N., & Takeda, S. (2019). Assessing Wa-u agroforestry in the course of swidden transformation: A case study in southern Chin State, Myanmar. *Small-scale Forestry, 18*(8), 353-372. https://doi.org/10.1007/s11842-019-09422-8

Cherrier, J., Maharjan, K. L., Shree, K., & Maharjan, M. (2018). Shifting cultivation misconception of the Asian government. *Journal of International Development and Cooperation, 24*(1-2), 71-82.

Dhakal, C., Khadka, S., Park, C., & Escalante, C. L. (2022). Climate change adaptation and its impacts on farm income and downside risk exposure. *Resources, Environment and Sustainability, 10*, 100082. https://doi.org/10.1016/j.resenv.2022.100082

Eckstein, D., Künzel, V., & Schäfer, L. (2021). *Global Climate Risk Index 2021: Who suffers most from weather extreme events? Weather-related loss in 2000-2019*. Berlin: Germanwatch.

Erni, C. (2015). *Shifting cultivation, livelihood, and food security, new and old challenges for Asian Indigenous peoples*. Food and Agricultural Organization for the United Nations, International Work Group for Indigenous Affairs, and Asia Indigenous Peoples Pact, Bangkok, http://www.fao.org/3/a-i4580e.pdf

Enete, A. A., & Onyekuru, N. A. (2016). Challenges of agricultural adaptation to climate change: The case of cassava post-harvest in Southeast Nigeria. *International Journal of Climate Change Strategies and Management, 5*(4). https://doi.org/10.1108/IJCCSM-08-2012-0045

Food and Agriculture Organization of the United Nations (FAO). (2007). *Adaptation to climate change in agriculture, forestry, and fisheries: Perspective, framework, and priorities*. Open Journal of Ecology, 11(7). https://doi.org/10.4236/oje.2021.117035

Food and Agriculture Organization of the United Nations (FAO). (2022). *Handbook on the integrated crop management of rice and paddy for farmer field schools in the central dry zone of Myanmar: Climate-Friendly Agribusiness Value Chains Sector (CFAVC) project*. Global Agriculture and Food Security Programme (GAFSP). https://doi.org/10.4060/cc1163en

Frisard, C., & Petit, A. (2019). *The evolution of farming systems and diet in Hakha Township, Chin State, Myanmar*. LIFT Fund.

Girma, S. (2020). Farmers' perceptions of climate change and determinants of choice of adaptation strategies in central Ethiopia. *Ecological Processes, 7*(7). https://doi.org/10.1186/s13717-018-0118-8

Hein, Y., Vijitsrikamol, K., Attavanich, W., & Janekarnkij, P. (2019). Do farmers perceive the trends of local climate variability accurately? An analysis of farmers' perceptions and meteorological data in Myanmar. *Climate, 7*(5), 64. https://doi.org/10.3390/cli7050064

Hickey, S. & Maria-Sube, E. (November 2022). Environmental, climate change, and natural resources management. Myanmar Environment and Climate Change Challenges. *International IDEA Policy Paper No. 27*. https://doi.org/10.31752/idea.2022.59

Hudson-Rodd, N., & Htay, S. (2015). Farmers, land and military rule in Burma. In *Economic development, the rural economy and labour rights* (Part III). Cambridge University Press.

Hein, Y., & Vijitsrikamol, K. (2019). Do farmers perceive the trends of local climate variability accurately? An analysis of farmers' perceptions and meteorological data in Myanmar. *Climate, 7*(64), 1-21.

Institute for Chin Affairs. (2023). *The Myanmar military's human rights violations against the Chin people after the military coup* (From February 2021 to October 1, 2023).

International Food Policy Research Institute. (2024). *The state of food security and nutrition 2021-24: Findings from seven rounds of the Myanmar household welfare survey.* International Food Policy Research Institute.

Jones, R. N., Patwardhan, A., Cohen, S. J., Dessai, S., Lammel, A., Lempert, R. J., Mirza, M. M. Q., & von Storch, H. (2014). Climate change 2014: Impacts, adaptation, and vulnerability. Part A: Global and sectoral aspects. In C. B. Field, V. R. Barros, D. J. Dokken, M. D. Mastrandrea, K. J. Mach, T. E. Bilir, M. Chatterjee, K. L. Ebi, Y. O. Estrada, R. C. Genova, B. Girma, E. S. Kissel, A. N. Levy, S. MacCracken, P. R.

Mastrandrea, & L. L. White (Eds.), *Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* (pp. xxx-xxx). Cambridge University Press.

Kerkhoff, E., & Sharma, E. (2006). *Debating shifting cultivation in the Eastern Himalayas: Farmers' innovations as lessons for policy*. International Centre for Integrated Mountain Development.

Kreibich, H., Müller, M., Thieken, A. H., & Merz, B. (2007). Flood precaution of companies and their ability to cope with the flood in August 2002 in Saxony, Germany. *Water Resources Research, 43*, W03408. https://doi.org/10.1029/2005WR004691

Knox, J., Hess, T., Daccache, A., & Wheeler, T. (2012). Climate change impacts on crop productivity in Africa and South Asia. *Environmental Research Letters, 7*(3), 034032.

Laidler, G. J. (2006). Inuit and scientific perspectives on the relationship between sea ice and climate change: The ideal complement? *Climatic Change, 78*(2-4), 407-444.

Leman, F. K. (1963). *The structure of Chin society: A tribal people of Burma adapted to a non-western civilization*. University of Illinois Press.

Mark, S. (2016). Fragmented sovereignty over property institutions: Development impacts on the Chin Hills communities. *Index Journal of Burma Scholarship, 1*(1), 131-160.

Mawng Maung Shwe, L., Shrestha, R. P., Ebbers, T., & Jourdain, D. (2015). Farmer's perception and adaptation to climate change impacts in the Dry Zone of Myanmar. *Climate Change and Development*. https://doi.org/10.1080/17565529.2014.989188

McCarthy, J. J., Leary, N. A., Dokken, D. J., & White, K. S. (Eds.). (2001). *Climate change 2001: Impacts, adaptation, and vulnerability. Contribution of Working Group II to the Third Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press.

Mertz, O., Padoch, C., Fox, J., Cramb, R. A., Leisz, S. J., Lam, N. T., & Vien, T. D. (2009). Swidden change in Southeast Asia: Understanding causes and consequences. *Human Ecology, 37*, 259-264. https://doi.org/10.1007/s10745-009-9245-2

Molua, E. L., & Lambi, C. M. (2006). *The economic impact of climate change on agriculture in Cameroon* (Centre for Environmental Economics and Policy in Africa (CEEPA) Discussion Paper No. 17). Special Series on Climate Change and Agriculture in Africa.

MONREC-NUG. (2021, July 12). Submitted progress report related to the Nationally Determined Contributions (NDC) to the UNFCCC.

Myanmar Institute for Integrated Development. (2014). *Support to Chin State's comprehensive 5-year development plan and annual planning 2016-2021 with local social plan*. Myanmar Institute for Integrated Development.

Ndamani, F., & Watanabe, T. (2015). Farmers' perceptions about adaptation practices to climate change and barriers to adaptation: A micro-level study in Ghana. *Water, 7*(9), 4593-4604. https://doi.org/10.3390/w7094593

Ozturk, & Wang, W. (2019). Adapting climate change challenge: A new vulnerability assessment framework from the global perspective. *Journal of Cleaner Production, 217*(3). https://doi.org/10.1016/j.jclepro.2019.01.162

Phyo, A. S., Grünbühel, C. M., & Soe Soe, H. (2015). Changing livelihoods of farming and landless households in Ayeyarwaddy Delta. *Asia Pacific Sociological Association Conference: Transforming Societies: Contestations and Convergences in Asia and the Pacific*.

Root, R. L. (2023). Myanmar: Forest conservation at risk as illegal logging intensified under military rule. *Business and Human Rights Resource Centre*.

Szott, L. T., Palm, C. A., & Buresh, R. J. (1999). Ecosystem fertility and fallow function in the humid and subhumid tropics. *World Agroforestry*. https://doi.org/10.1023/A:1006215430432

Tun, M. M. (2022). *Asian Disaster Reduction Center Visiting Researcher Program FY 2022: Country report of Myanmar 2022*.

Tun Oo, A., Van Huylenbroeck, G., & Speelman, S. (2018). Assessment of climate change vulnerability of farm households in Pyapon District, a delta region in Myanmar. *International Journal of Disaster Risk Reduction, 28*, 10-21.

UNICEF. (2023, May 26). *Myanmar humanitarian situation report No. 7 (Cyclone Mocha)*.

Venkatappa, M., Sasaki, N., Han, P., & Abe, I. (2021). Impacts of droughts and floods on croplands and crop production in Southeast Asia: An application of Google Earth Engine. *Science of the Total Environment*. https://doi.org/10.1016/j.scitotenv.2021.148829

Waibel, H., & Pahlisch, T. H. (2013). Farmers' perceptions of and adaptations to climate change in Southeast Asia: The case study from Thailand and Vietnam. In *Climate smart agriculture*. https://doi.org/10.1007/978-3-319-61194-5_7

Wildcat, D. R. (2013). Introduction: Climate change and indigenous peoples of the USA. In J. K. Maldonado, B. Colombi, & R. Pandya (Eds.), *Climate change and indigenous peoples in the United States*.

World Bank. (2022, October). *What you need to know about food security and climate change: Climate explainer series*. World Bank.

Zapata Ríos, X., Rhoades, R. E., & Ochoa, J. A. (2008). Climate change in Mama Cotacachi: History, local perceptions, and social impacts of climate change and glacier retreat in the Ecuadorian Andes. *Climatic Change*, 85, https://doi.org/10.1079/9780851999494.0064

.