Gender issues faced by women farmers in climate change adaption (In case of Tuv Province, Mongolia)

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Abstract

This research examines how the increased frequency of natural disasters driven by climate change has undermined the livelihoods of women farmers and adversely affected their socio-economic status, thereby weakening their resilience and capacity to cope with climate change. Using mixed research methods, the study focused on women farmers in Bayanchandmani and Jargalant soums[1] of Tuv[2] province of Mongolia, who primarily grow potatoes and vegetables. The study was grounded in the Feminist Political Ecology Framework and Sustainable Livelihood Framework, incorporating methods for calculating vulnerability and climate adaptation and resilience, and examining the interlinkages between climate vulnerability and gender. In doing so, the study analysed both primary and secondary data, drawing on findings from document review as well as quantitative and qualitative research. The findings indicate that climate change has heightened the vulnerability of marginalised groups who depend on agriculture for their livelihoods and have limited capacity to adapt and respond to climate-related challenges. Although farm households experience increased burdens during natural disasters regardless of their capacity to cope with and withstand climate change, vulnerable groups with lower resilience are more severely affected. This study expands the existing body of literature on gender and climate change in the context of Mongolia.

Key words

Climate change, natural disasters, women farmers, climate adaptation and resilience

[1] Administrative unit of Mongolia in rural areas.
[2] Tuv province is located in the center of Mongolia and includes the Capital city of Mongolia in its territory.

Background

Climate change in Mongolia is intensifying, with the average annual temperature increased by 1.9°C in 2024, and it was the second warmest year since 1940 (National Agency Meteorology and the Environment Monitoring , 2024) and the frequency of natural disasters such as drought, zud, wind, storms, and floods is increasing, 76.9% of total territory in Mongolia has been affected by desertification (Ministry of Environment and Tourism of Mongolia, GEF and UNEP, April, 2024), as well as pastureland degradation and water scarcity is taking place rapidly.

Agriculture is recognised as one of the contributing factors to climate change; at the same time, it is strongly influenced by climate change and its consequences (Goli, Najafabadi, & Lashgarara, 2020). Particularly, climate change severely affects the farming sector. According to the assessment, the share of desertification in the total land area of Mongolia has increased to 72.0-76.9%. Of this, 87% is caused by human activity, and 13% by climate change and changes in natural factors. (Mongolian Economy, 2025) Only 1 per cent of Mongolia's land is used for agriculture, and the country's harsh climate and high desertification limit agricultural opportunities (Food Revolution National Movement, 2024). A total of 16.2 thousand households and 1.5 thousand enterprises and organisations are operating in the agricultural sector in 2024. As of 2024, the total cultivated area was 354.4 thousand hectares of wheat, 132.4 thousand hectares of technical crops, 100.8 thousand hectares of fodder crops, 20.2 thousand hectares of vegetables, and 19.6 thousand hectares of potatoes (Food Revolution National Movement, 2024). This has led to the loss of traditional livelihoods of farmers, affecting vegetable cultivation and harvest, causing food shortages and negatively affecting food security. Furthermore, the economic situation of farmers is likely to become unstable, deepening gender inequality and facing more complex gender-related issues. The most frequently cited risks for farmers were price volatility (64%), summer heat and drought (54%), and heavy rains and floods (49%), while for vegetable farmers, landslides (82%), lack of rain (76%), seasonal heavy rains (72%), or price increases for vegetable market price increase (68.6%) were mentioned as having a high or very negative impacts (Ministry of Food, Agriculture and Light Industry, 2020).

Mongolia's vegetable sector is dependent on the environment and weather, and is highly vulnerable to climate change. In Mongolia, 80% of agricultural land belongs to the central region, 11% in the eastern region, and 9% in the western region, according to 2020. These are mainly non-irrigated crops and are directly dependent on agro-weather conditions (Ministry of Environment and Tourism of Mongolia, GEF and UNEP, April, 2024). In addition, due to traditional farming and cultural influences, property ownership is registered in the name of the head of the household (which is predominantly male), though food and vegetable production is a family business, it is predominantly women's work and a significant proportion of potato, vegetable, and greenhouse farmers are women, including single-headed households and elderly retirees (IMPACT – Improve – Act! En-gendering rural economic development in Mongolia, Mongolian Women's Fund, 2022). Therefore, it is important to study the situation of overcoming climate change through gender policies at the international, regional and national levels. Moreover, there is a need to explain the gender-based challenges faced by farmers in Mongolia, particularly women vegetable growers, due to climate change, especially from the perspective of coping with and resilience to climate change.

Since climate change is expected to exacerbate current vulnerabilities and inequalities (Ilona M. Otto, 2017) this study examines the different gender issues that arise in social groups, especially farmers, including women and vulnerable groups, due to climate change, and uses a mixed research methodology to identify the current social landscape, sensitivity to climate change, and gender related issues in relation with climate adaptation and resilience including women farmers' socio-economic status, and conducts in-depth research at the local level. Moreover, the main objective of the research is to identify how the socio-economic conditions of women farmers affect their ability to cope with and withstand climate change.

Theoretical background

Feminist Political Ecology (FPE) framework demonstrates how social identities are constituted in and through relations with nature and it marks a noteworthy moment in environmental studies by demonstrating the analytical purchase of feminist political ecology to identify how inequality is (re)produced when women's environmental engagements,

knowledge, and activism are neglected (Sundberg, 2017). FPE's key points are gendered access to land, water and natural resources, women farmers' knowledge on agriculture and power dynamics in environmental governance. Moreover, FPE highlights how structural inequalities shape climate vulnerabilities and adaptive capacities. Guided by FPE, this study examines how gendered experiences of climate adaptation and resilience are shaped not only by gender roles but also by intersecting socio-economic factors such as age, education, income level, and local experience. Also, the FPE framework is seen as one that treats gender as a critical variable in shaping resource access and control, interacting with class, caste, race, culture, and ethnicity to shape processes of ecological change, the struggle of men and women to sustain ecologically viable livelihoods, and the prospects of any community for "sustainable development" (Rocheleau, Thomas-Slayter, & Wangari, 2013). FPE acknowledges other identities, such as race, ethnicity, and sexuality, that intersect with gender influencing women's agricultural practices (Duo, 2024). By focusing on these intersecting differences, the study aims to uncover the structural inequalities embedded in climate adaptation practices and to identify pathways for inclusive, justice-based resilience-building in the Mongolian context. Working at the nexus of nature, power, and knowledge production, FPE promises to continue supporting broader feminist political objectives for more equitable and ecologically viable futures (Sundberg, 2017).

A livelihood comprises the capabilities, assets, and activities required for a means of living. It is deemed sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities, assets, and activities both now and in the future, while not undermining the natural resource base (Asian Development Bank, 2017). The sustainable livelihoods approach is a way of thinking about the objectives, scope, and priorities for development activities (Asian Development Bank, 2017), which consists of six inter-linked elements: Vulnerability context, Livelihood assets, Influence and access, Transforming structures and processes, Livelihood strategies and Livelihood outcomes (Natarajan, Newsham, Rigg, & Suhardiman, 2022). "Climate and environmental context/relations" recognises the need to both elucidate local-level climate and environmental contextual factors and also to do so in a relational sense, understanding how these are shaped by broader forces, and also how they shape rural livelihoods (Natarajan, Newsham, Rigg, & Suhardiman, 2022). According to the Sustainable Livelihood Framework (SLF), climate

change and environmental impacts are one of the main factors influencing the livelihoods of rural residents in the twenty-first century.

On the other hand, vulnerability is characterised as insecurity in the well-being of individuals, households, and communities in the face of changes in their external environment (Asian Development Bank, 2017). Vulnerability indicates the ease of an affected system or the inability to deal with the adverse effects of climate change, including climate variability and extreme weather (Subiyanto, Boer, Aldrian, & Kinseng, 2020). In accordance with the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (AR5) (Intergovernmental Panel on Climate Change, 2014), the concept of vulnerability is influenced by sensitivity and adaptive capacity and formulated as below:

$$\mathbf{V = S/AC}$$

V=Vulnerability

S=Sensitivity

AC=Adaptive Capacity

Climate signal and direct physical impacts (hazard) that occur within both social and ecological systems require adaptation, so the impact can be minimised. Adaptability in socio-ecological systems is often known as resilience (Subiyanto, Boer, Aldrian, & Kinseng, 2020). Therefore, socio-economic indicators are assessed when measuring climate resilience and climate vulnerability as well as evaluating climate adaptation efforts. In the context of climate change, resilience is often associated with “adaptation”; while in disaster, risk replaces “vulnerability reduction” (Subiyanto, Boer, Aldrian, & Kinseng, 2020)

There is consensus that climate vulnerability is gendered and that gender-responsive Climate Smart Agriculture (CSA) has the potential to close the gender gap in agriculture. Research and innovation efforts need to develop a better understanding of the interlinkages between gender equality and transformation and the social, cultural, economic, and political dimensions (Huyer, Loboguerrero, Chanana, & Spellman, 2024) and other climate change adaptation measures is of particular importance, individuals, groups, national, local and scientifc authorities, indigenous communities, international organizations, the United Nations, public and private institutions and corporations at all levels and in all sectors should be called upon to make ethical decisions and take appropriate actions to respond and adapt

to climate change at the international, regional, national and local levels (Goli, Najafabadi, & Lashgarara, 2020).

The SLF offers a valuable structure for analyzing climate adaptation and resilience in Mongolia, particularly when combined with gender-responsive and intersectional lenses. It highlights that resilience is not only ecological but also social and political, shaped by who controls resources, who has a voice in adaptation, and who carries the burden of climate impacts. Addressing socio-economic differences, especially among rural women, is key to building equitable and sustainable livelihoods under climate stress.

Research methods

As Tuv province supplies about 70 per cent of the country's potatoes and vegetable needs (National Statistics Office, 2024), the subjects of this study were selected from women farmers in Bayanchandmani and Jargalant soums of Tuv province, who mainly grow and supply potatoes and vegetables, which are land-intensive and vulnerable to climate change, and the study was limited to the regional level.

Quantitative and qualitative methods were used in data collection. The main research method, the questionnaire, was developed based on the questions of the survey (Nelson & Lambrou, 2010) conducted by the Food and Agriculture Organization of the United Nations (FAO) in the Republic of India and the gender transformative method (UNICEF, 2024) issued by the United Nations Children's Fund, and was validated through pilot research.

Group discussions were held with women vegetable farmers in Bayanchandmani and Jargalant soums of Tuv province, while individual interviews were conducted with representatives of government agencies. In parallel, content analysis of statistical data and relevant research reports on the environment, climate, agriculture—including the agricultural sector—and gender was used to explore the relationships among these factors.

The study analysed primary and secondary data and processed data based on the results of document research, quantitative and qualitative research. To process the data collected through the questionnaire, SPSS-25.0 software was used to analyse the descriptive statistics,

correlation analysis, and relationships between questions. In the context of research, the most common measure of internal consistency of a factor, i.e. factor reliability, Cronbach's Alpha was calculated. The raw data from the qualitative research was analysed using the "Grounded Theory Approach," a systematic analysis method.

Research contributions

The results of this study can be used by government and non-government organisations and researchers to develop national policies and plans for climate change mitigation and adaptation. For example,

- Use research findings to support the implementation of actions in the environmental sector as outlined in Target 5.3 of the Cross-Sectoral Strategic Plan for Promoting Gender Equality (2022-2031).
- Support the implementation of the Cross-sectoral Strategic Plan for Promoting Gender Equality adopted by Tuv province in 2023, improve its objectives, and plan and implement tangible gender activities.
- Include the research findings in the biannual Government report on the implementation and results of activities to ensure gender equality and integrate into national climate and development strategies.

National climate policy towards gender equality

Recognizing the urgency of addressing the negative impacts of climate change, the Government of Mongolia took immediate action by joining the United Nations Framework Convention on Climate Change (UNFCCC) in 1993, the Kyoto Protocol in 1999, and the Paris Agreement on Climate Change in 2016. In September 2015, Mongolia submitted its first Nationally Determined Contribution (NDC) under the UNFCCC, pledging to reduce greenhouse gas emissions by 14% by 2030. This target was later updated to a 22.7% reduction by 2030. Adaptation to climate change is addressed through various laws and policy documents, including Mongolia's National Security Concept (2010), the National Action Program on Climate Change (2011), the Green Development Policy (2014), and the long-term development policy "Vision-2050," all of which reflect the country's strategies

on the issue. However, there is no specific law on climate change. (Ministry of Environment and Tourism, Green Climate Fund, UNEP, 2021)

According to the Law on Promotion of Gender Equality (LPGE), all sectors are required to develop and adopt sectoral policies to ensure gender equality. The LPGE is one of the international best practices in promoting gender equality and provides for the integration of gender equality principles into sectoral laws and policies. Mongolia's relevant climate change and disaster resilience laws, policies, and plans do not yet address gender issues and gender-based vulnerabilities arising from climate change and environmental degradation.

Goal 5 of the "Cross-Sectoral Strategic Plan for Gender Equality (2022-2031)" approved by the National Committee of Gender Equality (NCGE) states that gender equality should be ensured in climate change mitigation and adaptation. It considers climate change and gender issues in an integrated manner by setting three main goals: (1) gender-sensitive planning and implementation of climate change mitigation, adaptation, and mitigation policies and their management; (2) gender equality in environmental protection, sustainable consumption, and green jobs; and (3) building the capacity of women, men, and social groups to mitigate climate change.

As mentioned before, Mongolia does not have a specific law on climate change, and in particular, there are no national laws and regulations that regulate climate change. However, the Ministry of Economy and Development is currently responsible for organizing discussions on the Climate Change Law and discussing it with the relevant committees of the State Great Khural (The Parliament of Mongolia). Measures to adapt to, mitigate, and address cross-sectoral issues related to climate change have been reflected in the long-term development policy "Vision 2050", "NDC", "Government Action Plan", and "New Recovery Policy" within the framework of relevant sectors.

The "Gender Strategy for the Environment Sector 2014-2030" of Mongolia is an important policy document that integrates gender equality policies with green development policies. The mission of this strategy is to support the implementation of green development programs by ensuring equal participation and equal access based on the different development needs of men and women, social groups, and localities. The strategic action plan clearly outlines activities aimed at studying environmental issues from a gender-sensitive perspective and

collecting data, and using them in policy and planning; on the other hand, it aims to support and guide active participation based on the differential knowledge, experience, and resources of rural households, men, and women.

Gender policy and planning of Tuv province and its implementation

Tuv province has a total area of 74,042.37 km2, of which the agricultural rotation area is 301.6 thousand ha, and a total of 4.9 million head of livestock. The total population as of 2024 is 91,786, of which 47,503 are males and 44,283 are women. The total number of households is 28,845, and the working-age population is 38,746, of which 20,049 are men and 18,698 are women. The number of people employed in the agricultural sector is 21,253, of which 11,294 are men and 9,959 are women (Agricultural Department of Tuv Province, 2024).

Gender policy and planning. In 2018, the Province's Sub-Program for Ensuring Gender Equality was approved by Resolution No. 116 of the People's Representatives' Meeting of Tuv Province. The program implementation period was 2018-2021, and the implementation of the sub-program was reviewed annually by the NCGE to assess the progress and results of the activities. Also, relevant objectives have been set to implement the program's goals, but no objectives or activities related to climate change or natural disasters have been set.

In 2023 Article 19.1 of the Law on Promotion of Gender Equality (LPGE), Articles 6.2 and 6.7 of the Charter of the NCGE, and the Action Plan for the Implementation of the 2020-2024 Action Program of the Provincial Governor, the Cross-sectoral Strategic Plan for Promoting Gender Equality(CSPPGE) of Tuv Province (2023-2026) was approved. This strategic plan has five main goals, and Goal 5 states that gender equality will be ensured in climate change mitigation and adaptation. Within this goal, one of the main objectives is to organize technology and training to increase vegetable and fruit production and household farming for women farmers in the face of climate change, develop gender-sensitive financial and credit services, and improve women's working conditions, 5.1.3 to improve the Labour safety and health as well as social protection of women and men working in the agricultural sector, and support decent employment in cooperation with relevant organizations, and 5.1.7

to organize disaster prevention training at least 3 times a year, ensuring gender equality for each category.

In 2023, the implementation of the activities of the local administrative organisation through the LPGE was evaluated, and Tuv province was evaluated with 35 criteria in 2022 and an average of 43 criteria in 2023, ranking first among the other 20 provinces and the capital city. The provincial CSPPGE was approved and started implementing.

In 2024, 10 women representatives were elected to the Tuv Province's People's Representative Meeting, a woman secretary of the People's Representative Meeting was appointed, and a woman advisor to the provincial Governor was appointed. Although the 2024 Action Plan of the Provincial Sub-Committee on Promoting Gender Equality included activities to be carried out under the 4th objective of the CSPPGE, it did not specify measures to be carried out under the 5th objective, which is related to climate change.

The 2025 plan is more realistic and gender-responsive than previous years, focusing on men's and boys' health, preventive screening, psychological services, and training. However, it does not specify measures to address the challenges facing farmers due to climate change, or in line with Objective 5 of the strategic plan.

Bayanchandmani soum: Agriculture plays a key role in the economy of Bayanchandmani soum, Tuv province, and contributes significantly to the livelihood of the population. The centre of the soum is located 72 km from Ulaanbaatar city and 110 km from Tuv province. According to the soum's Department of Agriculture, the area of land used for vegetables and agricultural land in the soum is 3,796 hectares, of which vegetables are cultivated on 120 hectares, potatoes on 560 hectares, crops on 250 hectares, and green fodder on 2,866 hectares. There are 20 enterprises and 250 citizens working in the agricultural sector. Of these, 100 are women, or 40%.

Jargalant soum. Agriculture plays an important role in the economy of Jargalant soum, Tuv province, and vegetable and grain production is widespread. The centre of the soum is located 135 km from Ulaanbaatar city, 180 km from Tuv province, and 138 km from

Darkhan city, and has the advantage of being located in the most convenient market point 62 km from the railway station between the three cities. The soum has 38,741 hectares of cultivated land. Of this, 15,931 hectares are used for potatoes and vegetables, and 22,810 hectares are used for crops. According to the soum's Governor's Office, the number of micro-entrepreneurs in the soum is 39, and 19 women have permanent jobs in 16 farms in Jargalant soum.

Agriculture and animal husbandry are developing in Jargalant and Bayanchandmani soums at the same time. According to the National Statistics Office's (NSO) 2023 year-end report, 2,367 households in Tuv province are engaged in agriculture, of which 250 households in Bayanchandmani and 581 households in Jargalant are engaged in agriculture.

Table 1. Numbers of farmers, 2024

№	Soums	Total	2024			
			Male	Percentage	Female	Percentage
1	Bayanchamdan soum	250	179	71.6%	71	28.4%
2	Jargalant soum	581	284	48.9%	297	51.1%

Source: NSO of Mongolia

Research Outcomes

A total of 156 women farmers from Bayanchandmani and Jargalant soums of Tuv province participated in the quantitative survey questionnaire conducted as part of the study. 97.4 per cent of the women farmers who participated in the survey are officially registered in their place of residence, and 96.7 per cent have not moved in the last 3 years. In terms of education level, 46.1 per cent had higher education, 19.2 per cent had technical and vocational education, and 32.1 per cent had secondary education. 49.4 per cent have been working in the agricultural sector for more than 13 years, 15 per cent for 10-13 years, 13 per cent for 7-10 years, 14 per cent for 4-7 years, and the remaining 9 per cent have 1-3 years of experience. 57.1 per cent live in privately owned houses to live, and 28.8 per cent live in gers. The

average age of the survey participants was 45.5, and they were mostly women farmers from households with up to 4 members.

Most of the survey participants, 53.2 per cent, grow potatoes and vegetables on their own land, while 35.9 per cent grow potatoes and vegetables on rented land. They own a minimum of 0.7 hectares and a maximum of 98 hectares of land, with 33.3 per cent of their land registered, or mostly, in the husband's name, while 9.6 per cent is in the wife's name, and the rest is owned by their brother, father, or jointly. The average monthly household income was 1,957,926 MNTs[3].

In the last 10 years, 28.2 per cent considered climate change to be very severe, 39.1 per cent considered it to be severe, and 28.8 per cent considered it to be moderate. In Bayanchandmani soum, 29.2 percent of respondents said they had faced drought, 27 percent said they had faced strong winds and storms during their farming activities, while in Jargalant soum, 50.7 percent said they had faced drought, 40.3 percent said they had faced freezing temperatures, and 46.3 percent said they had faced extreme heat.

In order to further analyze the decline in household conditions and livelihoods of the women farmers and the impact of poverty on the increase in the frequency of natural disasters caused by climate change, the climate resilience[4] were coded using five basic socio-economic indicators: age, education, years of work in the agricultural sector, monthly income, and land ownership of the study participants as follows.

- The average age of participants was 45, with ages 24-44 being decoded as 1, and ages 45-77 as 0.
- Education level is 1 if you have higher education, 0 if you do not have higher education.
- If you have worked in the agricultural sector for 1-10 years, it is 0, and if you have worked for more than 10 years, it is 1.

[3] Mongolian National Tugriks
[4] Climate resilience is the ability to thrive in the face of multiple risks and threats posed by climate change.

- The average income per person was calculated as 568,700 MNTs. 46,500-568,700 MNTs is 1, 568,700-4,000,000 MNTs is 0.
- In terms of land ownership, it is 1 if you own your own land, and 0 if you do not own it.

These 5 factors were ranked by frequency, and if at least, 3 factors are 0, the climate resilience change is poor, if 3 factors are 1, the climate resilience is moderate, and if more than 3 factors are 1, the climate resilience is good, and they were divided into 3 main groups. Reliability was also calculated, and the Cronbach's Alpha coefficient for socio-economic factors was found to be 0.75, which meets the reliability criteria.

According to the 2022 "Household Financial Survey" conducted by the Bank of Mongolia, household income was categorised into specific groups. The monthly income per household member in the "lower middle or vulnerable" and "poor" categories closely corresponds to the average income per person in the "climate resilience is poor" group identified in this study..

Table 2. Household income grouping

Daily income per person, USD	**Monthly income per person MNT**	**Groups**
Upto 2 $	< 223,013 MNTs	Poor
2-5 $	< 557,533 MNTs	Lower middle/vulnerable
5-10 $	< 1,115,065 MNTs	Middle
10-20 $	< 2,230,130 MNTs	Upper Middle
Above 20 $	>=2,230,130 MNTs	Rich

Source: *(Bank of Mongolia, 2022)*

When performing a linear regression analysis between the ability to cope with climate change and the resilience group, household income is the main factor in coping with the negative impacts of climate change, while education level, land ownership, age group, and years of employment are also directly influencing factors for climate resilience. (Table 3)

This shows that the lower the income and education level, the more vulnerable women farmers are to climate change, and the lower their ability to cope with and withstand climate

change, or on the other hand, it means their climate resilience is low. Therefore, it can be said that climate change is deepening the vulnerability of vulnerable groups in society.

Table 3. Outcomes of the correlation analysis

		Three climate resilience groups	Age groups	Education level	Years of employment	Average income	Land ownership
Three climate resilience groups	Pearson Correlation	1	.387**	.476**	.216*	.508**	.441**
	Sig. (2-tailed)		0.000	0.000	0.017	0.000	0.000
	N	122	122	122	122	122	122
Age groups	Pearson Correlation	.387**	1	.291**	-.262**	0.041	-0.073
	Sig. (2-tailed)	0.000		0.000	0.001	0.652	0.364
	N	122	156	156	156	122	156
Education level	Pearson Correlation	.476**	.291**	1	-0.138	0.124	-0.034
	Sig. (2-tailed)	0.000	0.000		0.085	0.175	0.676
	N	122	156	156	156	122	156
Years of employment	Pearson Correlation	.216*	-.262**	-0.138	1	-0.084	0.102
	Sig. (2-tailed)	0.017	0.001	0.085		0.355	0.207
	N	122	156	156	156	122	156
Average income	Pearson Correlation	.508**	0.041	0.124	-0.084	1	0.117
	Sig. (2-tailed)	0.000	0.652	0.175	0.355		0.200
	N	122	122	122	122	122	122
Land ownership	Pearson Correlation	.441**	-0.073	-0.034	0.102	0.117	1
	Sig. (2-tailed)	0.000	0.364	0.676	0.207	0.200	
	N	122	156	156	156	122	156

Source: Calculated by the author based on collected data.

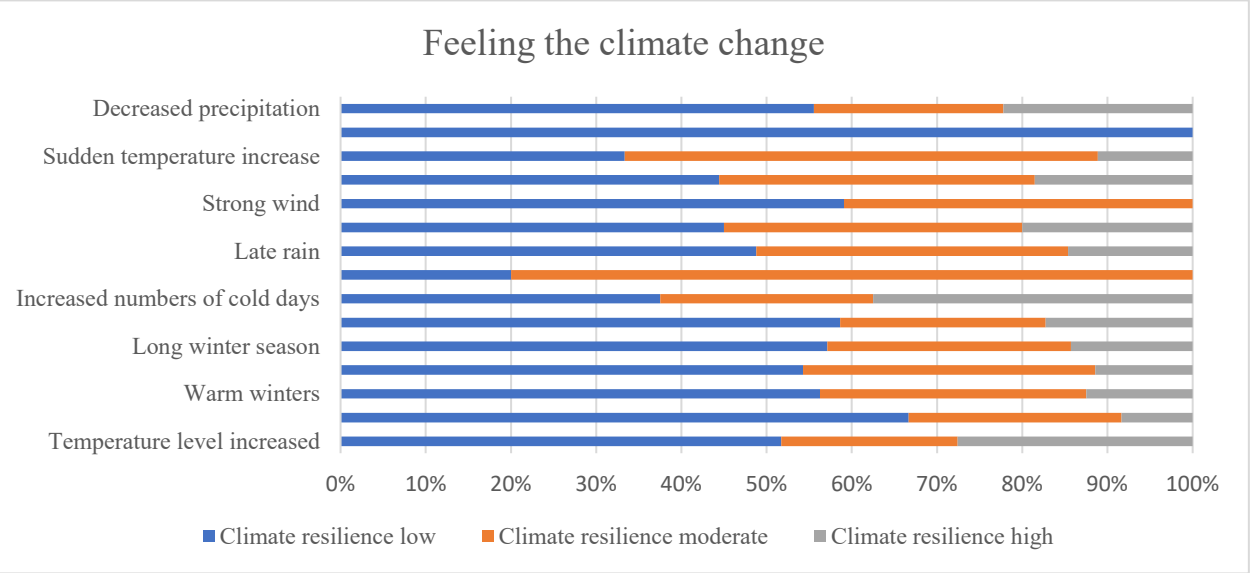
Box 1

Everything is inherently interconnected, with consequences that are mutually dependent. For instance, when addressing climate change, the concerns of girls, women, and vulnerable groups emerge as particularly sensitive and critical. The same applies to the agricultural sector—it's not just about growing vegetables; it also involves considering issues related to the education, health, and psychological well-being of girls and women.

From the individual interview

When analysing which climate changes were most commonly perceived by the three resilience groups, the low-resilience group reported experiencing over 50% of the changes, including increased precipitation, stronger winds, colder winters, and shorter summers. The moderate-resilience group also reported experiencing over 50% of the changes, particularly more frequent hot days and sudden warming of the soil. In contrast, the high-resilience group reported not experiencing any of these changes (Figure 1).

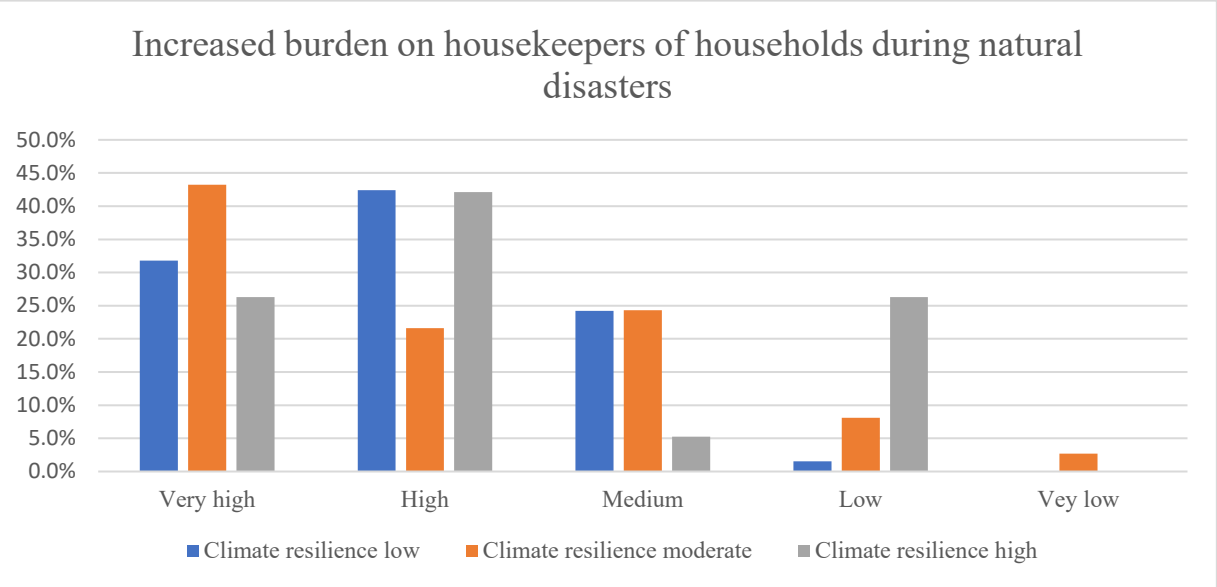
Figure1. Feeling the climate change



Source: Calculated by the author based on collected data.

For women farmers, the role and burden of being the housekeeper of the household increases regardless of their climate resilience, as a result of natural disasters caused by climate change (Figure 2).

Figure 2. Increased burden on housekeepers of households during natural disasters



Source: Calculated by the author based on collected data.

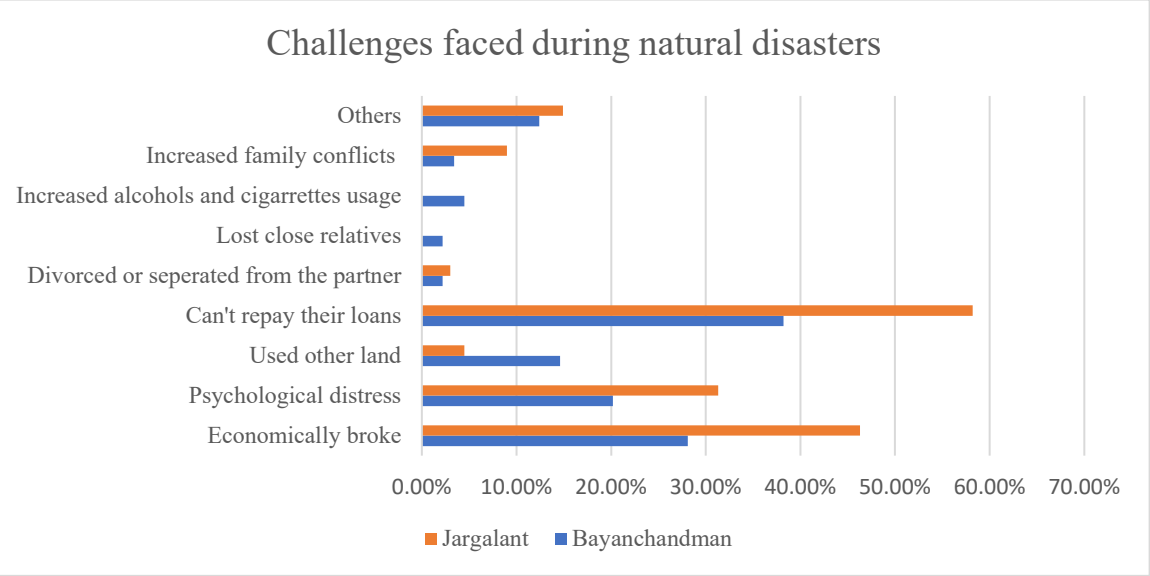
Box 2

Agriculture is heavily dependent on nature. Without rainfall, drought sets in, and crops like potatoes stop growing. If farmers fall behind schedule and fail to harvest in time, cold weather can arrive suddenly—snow may cover the fields, causing potatoes and vegetables to freeze and become unusable, rendering all their hard work in vain. Even when the harvest is successful, the lack of proper storage forces farmers to sell their produce at low prices to middlemen. Adding to these challenges is a severe shortage of labor.

From the individual interview

During the natural disaster, 38.2% of residents in Bayanchandmani soum were unable to repay their loans, 28.1% faced economic hardship, and 20.2% experienced psychological distress. In contrast, in Jargalant soum, the situation was more severe, with 58.2% unable to repay loans, 46.3% economically broke, and 31.3% suffering from psychological distress (Figure 3).

Figure 3. Challenges faced during natural disasters



Discussion

The increasing frequency of natural disasters caused by climate change is inevitable, and this study's strength lies in its use of a mixed-methods approach to confirm that the socio-economic indicators of women farmers, who sustain their livelihoods through agricultural activities, significantly affect their ability to cope with and withstand climate change. However, a limitation of the study is that it focused only on women farmers in Bayanchandmanii and Jargalant soums of Tuv province—areas where agriculture, particularly potatoes, is concentrated and particularly vulnerable to climate change due to the cultivation and supply of potatoes and vegetables. As such, the findings are regionally confined and not generalizable at the national level.

Moreover, this study reveals that women farmers in Bayanchandmani and Jargalant soums of Tuv province experience differing levels of climate adaptation that are deeply shaped by overlapping socio-economic and structural factors. Using a comparative lens, it becomes evident that climate adaptation and resilience varies significantly between individuals based on income, education, land ownership, age, and agricultural experience—with income emerging as the most influential predictor. Women with higher education levels, longer agricultural experience, and personal land ownership tended to have better climate

adaptation and resilience. Conversely, those with lower income and education were more vulnerable to climate impacts.

When comparing the findings of this study to the doctoral thesis (Nong, 2020), it concluded that the analysis of gender vulnerability to climate change largely depends on geographical location, climatic conditions, and socio-economic context. Similarly, our research also concluded that socio-economic indicators have a direct impact on women's vulnerability and their capacity to cope with climate change. The findings of the study (Ilona M. Otto, 2017) concluded that the poorest and most socially marginalised populations are the most vulnerable to climate variability and extremes. The study emphasised that social vulnerability to climate change is shaped not only by physical changes in the climate system but also by demographic, economic, institutional, and sociocultural factors. Alike, our study found that the capacity to cope with and adapt to climate change is directly influenced by the socio-economic characteristics of household members—particularly women farmers—including household income, education level, land ownership, and years of farming experience. Compared to the findings of the 2016 report (UN Women, 2016) which was conducted in the People's Republic of China, it was observed that the negative impacts of climate change and natural disasters disproportionately affect people with incomes below the subsistence level, as well as children, the elderly, and persons with disabilities. Equally, our study found that the increasing frequency of natural disasters caused by climate change leads to a decline in household livelihood levels and income, increasing the risk of poverty. Furthermore, this threatens the ability of individuals to remain sustainably employed in the agricultural sector.

Through intersectional analysis, it is clear that multiple dimensions of identity and disadvantage interact to influence vulnerability. For example, older women with limited education and no land title—especially in households where land is registered under male relatives—face compounded barriers to climate adaptation and resilience. In these cases, climate change not only affects agricultural productivity but also deepens existing gendered inequalities in land access, economic security, and decision-making power.

A few contrasts were observed between the two soums. Jargalant soum's women faced more severe climate impacts (e.g., higher reports of drought, freezing, and extreme heat) and reported greater socio-economic stress, including loan defaults and psychological distress.

This suggests that location-specific vulnerabilities must also be factored into adaptation and resilience strategies.

Interestingly, even among women with relatively higher resilience indicators, the burden of unpaid care and household responsibilities increased during climate-related disasters, demonstrating that gender roles persist as a universal source of strain regardless of economic status. This finding reinforces the necessity of addressing both material conditions (like land and income) and social norms (like unpaid labor expectations) in climate adaptation planning.

In the end, the findings confirm that vulnerable groups within the agricultural sector—particularly women farmers—are more likely to be affected by natural disasters resulting from climate change. To enhance the ability of climate-vulnerable women to cope with and adapt to climate change, it is essential to improve their socio-economic indicators—particularly income and education levels—by creating diverse income sources through well-coordinated policies, planning, and targeted interventions that not only address material needs such as land tenure and infrastructure but also challenge entrenched gender norms, thereby ensuring both short- and long-term resilience through multi-dimensional and intersectional approaches.

Conclusion

The study was conducted on the example of Tuv province, and the data were collected through document research, questionnaires, individual and focus group interviews, and the relevant analysis was conducted to draw the following conclusions.:

1. ***Household living standards***
    - The increasing frequency of natural disasters driven by climate change is negatively impacting household living standards and reducing household incomes.
    - This decline in income heightens the risk of poverty and undermines the sustainability of agricultural livelihoods..
2. ***Vulnerability to climate change***

- The vulnerability and vulnerability of social groups, with low ability to cope with and withstand climate change, has been observed to increase due to climate change.
- While all farming households face increased burdens during natural disasters, those with lower adaptive capacity—particularly vulnerable groups—are disproportionately affected.

3. Adaptation, coping, and resilience to climate change

- The ability to cope with and withstand climate change is directly related to the socio-economic indicators of household members, especially women farmers, including household income and education level, land ownership and years of experience in farming.

In conclusion, the study focused exclusively on women farmers who primarily grow potatoes in Bayanchandmani and Jargalant soums of Tuv province. For a more comprehensive understanding of gender-related challenges in the context of climate change and natural disasters, future research should broaden its scope to include diverse types of farmers across Mongolia and adopt a nationwide perspective.

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Ethics approval

The School of Graduate Studies of the National University of Mongolia granted ethics and copyright certification for this study.

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