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Strengthening the Role of Housewives in Climate Change Adaptation and Food Security in Ngargoretno Village, Magelang

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Abstract

The impacts of climate change, are significantly affecting Ngargoretno Village. While housewives play pivotal in ensuring household food security and climate adaptation, studies specifically identifying and mapping their contributions and adaptation strategies within Ngargoretno remain scarce. This research aims to identify the climate change vulnerabilities and risks faced by housewives, analyze the adaptation strategies they employ, and formulate recommendations to strengthen their role in climate adaptation and food security. The methodology employs a descriptive-qualitative approach utilizing in-depth interviews and observation, with data analyzed through thematic analysis. The findings reveal that the main vulnerabilities perceived by housewives include limited water infrastructure, frequent water scarcity, and increasing difficulties in rice cultivation. Identified climate change risks encompass susceptibility to landslides and food scarcity. Adaptation strategies implemented focus on strengthening women's groups to enhance household-level food security and developing the local economy through bamboo-based agricultural handicrafts. The success of these adaptations is strongly supported by women's traditional knowledge in water conservation and dietary diversification. It is recommended that the village government and relevant stakeholders bolster training programs for climate-resilient crop diversification, provide adequate rainwater harvesting infrastructure, and facilitate broader market access for the bamboo craft products managed by women's groups, ensuring sustainable adaptation and food security.

Introduction

Climate change represents one of the most pressing global challenges, exerting profound impacts across diverse sectors, most notably agriculture. As a cornerstone of food security, the agricultural sector plays an indispensable role in sustaining societal well-being. Dysfunction within this sector has far-reaching consequences, particularly for food availability, nutritional stability, and community welfare. Agricultural production is increasingly constrained by rising temperatures and erratic climatic conditions, both of which disrupt cultivation processes. These climate-induced stresses not only undermine productivity but also exacerbate social vulnerabilities. Furthermore, climate change intensifies soil erosion, leading to a decline in land productivity, the depletion of carbon and essential organic nutrients, and a progressive reduction in soil fertility (Ndruru & Masjud, 2024). Another factor that determines agricultural performance and food security is land conditions. Temperature and rainfall serve as key indicators of climate change that exert significant influence on land resources (Estiningtyas et al., 2024).

In addition to affecting crop quality and productivity, climate change directly impacts the unpredictability of harvest seasons and often results in crop failures (Salsabila et al., 2024). The following data from BPS illustrates the tangible impacts of climate change by comparing land area, productivity, and total production.

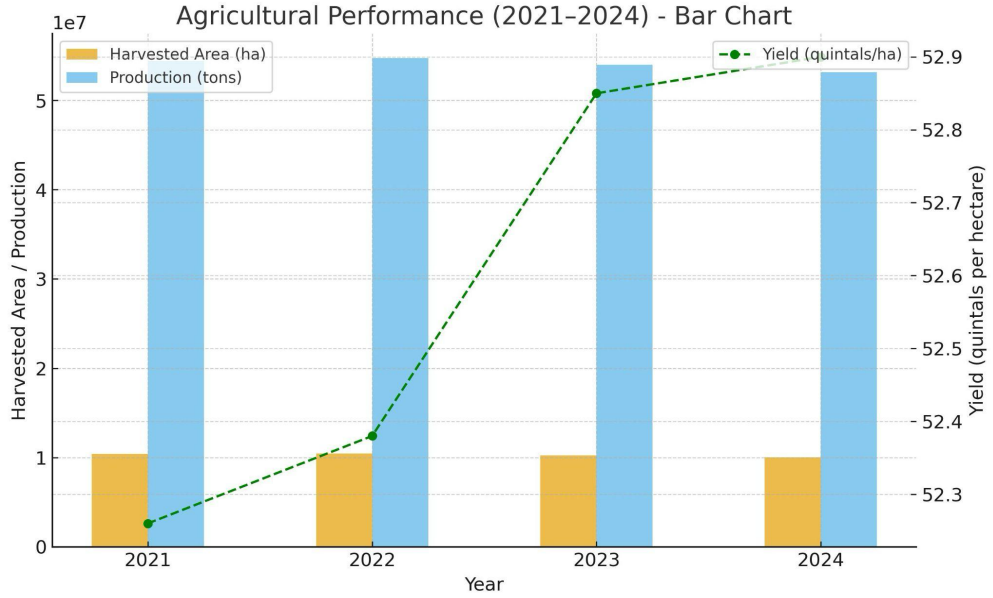

Fig 1. Agricultural Performance (2021-2024)
Sources: (BPS, 2024)

The analysis of agricultural performance from 2021 to 2024 reveals a declining trend in both harvested area and total production, despite a relatively stable yield per hectare. While yield levels fluctuated slightly from 52.26 quintals per hectare in 2021 to 52.90 quintals per hectare in 2024, the reduction in harvested area, from approximately 10.41 million hectares in 2021 to 10.04 million hectares in 2024,

contributed to the overall decrease in production volume, which dropped from 54.4 million tons to 53.1 million tons during the same period.

These patterns can be closely associated with the impacts of climate change, particularly rising temperatures and increasingly erratic rainfall. Such conditions exacerbate soil erosion, reduce soil fertility, and limit the availability of arable land, ultimately constraining the expansion of harvested areas (Harudu et al., 2025). Although productivity per hectare has been maintained at a moderate level, the contraction of cultivated land reflects the vulnerability of agricultural systems to climate-induced stress. This underscores the urgency of implementing climate-resilient agricultural practices to safeguard long-term food security.

In responding to the impacts of climate change, farmers encounter a range of structural and resource-related constraints. Limited knowledge regarding climate-resilient practices often hampers their ability to adopt adaptive strategies effectively. In addition, insufficient financial capital restricts investment in essential inputs and innovations, while limited access to high-quality seeds further reduces the potential for maintaining or increasing yields under changing climatic conditions(Rahma et al., 2025). The lack of appropriate agricultural technologies, including irrigation systems, soil management techniques, and climate-smart farming tools, exacerbates these challenges. Collectively, these constraints weaken farmers' adaptive capacity and resilience, thereby increasing their vulnerability to climate variability and extreme weather events (Food and Agriculture Organization of the United Nations, 2023; (Intergovernmental Panel on Climate Change, 2022).

This situation has made it increasingly difficult for farmers to adapt and to sustain food security. A concrete example can be observed in Mahang Sungai Hanyar Village, Hulu District, where farmers attempted to implement technology in chili cultivation. However, rather than improving resilience, this implementation created new challenges, as it fostered individualism within the community and further hindered collective adaptation efforts. Reflecting on this phenomenon, more effective adaptation strategies in agriculture should emphasize the utilization of local village potential while strengthening community integration (Abdilah & Hamid, 2023).

On the other hand, a unique phenomenon was found in Ngargoretno Village, located on the slopes of the Menoreh Mountains, where women play a strategic role in addressing the impacts of climate change. Ngargoretno Village, situated in Magelang Regency, represents an area with ecological conditions highly sensitive to climate variability. The village is recognized as a conservation-based tourism destination, where the community has transformed former marble mining sites into environmentally oriented attractions such as the Marble Nature Museum and Borobudur Dino Park. Collective environmental conservation activities have thus become an integral part of the community's climate mitigation and adaptation strategies, while simultaneously contributing to the development of the local economy (Pemerintah Kabupaten Magelang, 2023).

In this context, women hold a pivotal position. They are not only responsible for ensuring household food security and family health but are also actively engaged in environmental conservation, sustainable agriculture, and household waste management. Women's resilience, their capacity to endure, adapt, and innovate in the face of climatic and environmental pressures serves as a key driver in building climate-resilient rural communities. This finding is consistent with global studies highlighting that women play a crucial role in climate adaptation strategies, particularly through their knowledge of natural resource management, food production, and community-based resilience (Food and Agriculture Organization of the United Nations, 2021; UNDP, 2020; UN Women, 2022).

In Ngargoretno Village, women play a strategic role in safeguarding environmental sustainability while simultaneously strengthening community resilience to the impacts of climate change. One form of their contribution is through the conservation of bamboo and hardwood trees on mountain slopes, which function as natural landslide barriers and help maintain soil stability and water regulation. In addition, women are actively involved in environmental education by developing eco-educational tourism packages, such as tree-planting tours, bamboo garden excursions, and conservation training programs targeting tourists and students. At the household level, they play a crucial role in water and sanitation management, including efficient water use, recycling household waste into compost, and maintaining environmental cleanliness to ensure public health amid threats of drought or extreme rainfall.

Equally important, women in this village are also engaged in developing local food production through environmentally friendly agricultural practices, such as organic farming and intercropping systems. These initiatives contribute to household food security while reducing greenhouse gas emissions from the agricultural sector. Such active participation of women reflects a form of gender-based community resilience that not only adapts to but also provides concrete solutions to the climate crisis in mountainous areas. Referring to the study by Subiyanto et al. (2020), the extent to which a community adapts to the climate crisis can be assessed using a three-aspect framework, namely: vulnerability, risk, and resilience. (Subiyanto et al., 2020).

Despite the widely acknowledged importance of women in climate adaptation, a critical gap remains in the literature regarding the integrated analysis of the specific vulnerabilities, risks, and resilience mechanisms of women residing in ecologically sensitive conservation villages like Ngargoretno. Previous studies often address adaptation efforts in general agricultural contexts, overlooking the unique intersection of gendered responsibilities, local conservation-based economy, and specific geographical hazards (e.g., landslides) found here. This study addresses this empirical and analytical gap by offering a first-of-its-kind, gender-focused assessment that utilizes the established vulnerability-risk-resilience framework to systematically map the strategic role of housewives in a community actively

transitioning from mining to eco-tourism. The findings will thus provide novel, site-specific insights crucial for developing targeted, gender-responsive policy interventions.

Based on the observed phenomena and the aforementioned framework, this study formulates three key research questions. First, it seeks to explore the factors that contribute to the vulnerability of women living on the slopes of the Menoreh Mountains in Ngargoretno Village. Second, it aims to identify the main risks faced by these women in responding to the impacts of climate change. Third, the study examines how women in Ngargoretno Village demonstrate resilience in adapting to climate change. Together, these questions guide the analysis of gendered dimensions of vulnerability, risk, and resilience within the context of climate adaptation in ecologically sensitive mountainous areas. Referring to the research questions, the objectives of this study are threefold. First, it aims to examine the factors contributing to the vulnerability of women living on the slopes of the Menoreh Mountains in Ngargoretno Village. Second, it seeks to identify the main risks faced by women in responding to the impacts of climate change. Third, the study intends to analyze and identify the resilience demonstrated by women in adapting to climate change in Ngargoretno Village.

Methods

This study employs a descriptive qualitative approach with a case study method. This approach is applied to provide an in-depth and comprehensive description of the forms of women's resilience in facing climate change in mountainous slope areas. The qualitative approach enables the researcher to understand the experiences, perspectives, and meanings ascribed by the research subjects to their roles in climate mitigation and adaptation. The case study method is chosen because the research focuses on a specific location, Ngargoretno Village.Which possesses distinctive ecological and social characteristics as a conservation-based tourism village.

This research was conducted in August 2025 in Ngargoretno Village, Salaman Subdistrict, Magelang Regency, Central Java Province. The village was selected as the research site because it is a mountainous slope area actively engaged in conservation activities and ecotourism development. Moreover, it demonstrates strong participation of women in environmental management and local economic activities that are closely linked to climate change adaptation.

The data collection techniques in this study were carried out through in-depth interviews, participant observation, and documentation. In-depth interviews were conducted with women involved in conservation activities, environmentally friendly farming, water and sanitation management, as well as the development of educational tourism. A semi-structured format was employed to maintain flexibility while keeping the discussion focused on core issues. Participant observation was also applied, in which the researcher directly observed women's daily activities, their adaptation and mitigation practices, and social interactions within the community.

In addition, documentation was collected in the form of photographs, field notes, and supporting materials such as village activity reports, NGO programs, and secondary data obtained from local and village government sources.

The subjects of this study are housewives residing in Ngargoretno Village who are actively involved in climate change mitigation and adaptation activities, either through community groups (such as farmer women's groups, village tourism managers, and family welfare groups/PKK) or individually within the household sphere. The selection of subjects was conducted using purposive sampling, with criteria based on active participation and relevant experience. The number of informants was determined using the principle of data saturation, namely the point at which the information obtained becomes repetitive and no new significant insights emerge.

The data were analyzed using thematic analysis, a method that enables the identification, examination, and interpretation of recurring patterns or themes within qualitative data. The process began with data familiarization, where the researcher repeatedly reviewed transcripts, field notes, and documentation to gain a comprehensive understanding. This was followed by the coding stage, in which significant statements, expressions, and behaviors related to women's roles in climate change adaptation and mitigation were systematically categorized. The codes were then grouped and refined into broader themes that reflected the central aspects of women's vulnerability, risks, and resilience. Finally, these themes were interpreted in relation to the research questions and theoretical framework, allowing the researcher to provide a nuanced and evidence-based explanation of the findings.

Result

1.1.Vulnerability of Housewives in Ngargoretno Village to Climate Change

The vulnerability of housewives in Ngargoretno Village to climate change can be understood through three main dimensions: socio-economic, ecological, and knowledge-related. From a socio-economic perspective, most housewives rely heavily on agriculture and community-based ecotourism as the primary sources of household income. Since agriculture is highly dependent on climatic conditions, they are particularly vulnerable to crop failures, declining yields, and fluctuations in local commodity prices. Ecologically, the village's location on the slopes of the Menoreh Mountains exposes housewives to natural hazards such as landslides, droughts, and extreme rainfall, which directly threaten food security and household livelihoods. In terms of knowledge and adaptive capacity, although some women are actively engaged in conservation and community-based environmental tourism, many still face limited access to information, technology, and climate adaptation skills. This situation reinforces their position as a vulnerable group that requires institutional support, training, and capacity-building programs to reduce their vulnerability while strengthening household resilience against the impacts of climate change.

In Ngargoretno Village, the majority of women, approximately 90 percent, are housewives who also assist their husbands in farming and agricultural activities. Based on interviews with the village head, the main agricultural products cultivated in Ngargoretno include rice, cloves, cardamom, and several secondary food crops. As noted by the village head: *"At present, our agriculture has been affected by climate change. One of the major challenges is water scarcity and unpredictable seasons, making harvest times difficult to anticipate"* (Village Head Interview). Based on interviews with the village head, it was explained that one of the current vulnerabilities in agriculture in Ngargoretno Village is the irregularity of harvests caused by ongoing climate change. This condition has the potential to weaken local food security. As highlighted in Rozci (2024), climate change poses a serious threat to food security as it negatively affects the agricultural sector and, in particular, leads to significant crop losses.

On the other hand, many housewives in Ngargoretno still lack advanced agricultural skills, which restricts their ability to optimize farming practices and agricultural productivity. This limitation increases their dependence on traditional methods that are highly sensitive to climatic fluctuations. Furthermore, water scarcity remains a critical challenge in the village, as there are no water storage facilities or reservoirs to secure a steady supply. As a result, communities are forced to rely solely on natural rainfall and small-scale irrigation, which are often insufficient during prolonged dry seasons. The importance of water management was also emphasized during interviews, in which one respondent explained: *"We often struggle with a lack of water. There is no reservoir in our village, so we have to use water carefully, especially for household needs and farming"* (PKK). This highlights how water scarcity not only exacerbates the risks to agricultural productivity but also pressures women to adopt stricter water management strategies at the household level. To provide greater clarity, the following table presents the coding and theming results derived from the researcher's analysis.

Table 1. Theming and Coding of Vulnerability

Interview Excerpt	Code	Theme
"We often struggle with a lack of water. There is no reservoir in our village, so we have to use water carefully, especially for household needs and farming." (KWT)	Lack of water infrastructure	Water scarcity as a major agricultural risk
"Sometimes our harvest cannot be predicted. The rainy season and dry season no longer follow the usual pattern." (Village Head Interview)	Unpredictable seasons	Climate variability and harvest uncertainty

Interview Excerpt	Code	Theme
“Most of us women only help in farming but do not really know advanced techniques. We just follow what our parents used to do”(KWT)	Limited farming skills	Low adaptive capacity in agriculture
“When drought comes, our yields decrease and food becomes more expensive. We have to save on daily needs.” (KWT)	Declining yields and rising costs	Food insecurity due to climate risks

Resource: Primary Data (Conducted by researcher)

The interview data from Ngargoretno village, when subjected to thematic analysis, provides compelling empirical evidence regarding the gendered dimensions of climate change impact, aligning with the theoretical Vulnerability-Risk-Resilience (VRR) framework utilized in climate adaptation studies (Nyerges et al.,2021). The excerpts reveal specific factors contributing to vulnerability, the nature of climate risks perceived, and the present limitations in adaptive capacity. The interview finding, "We often struggle with a lack of water. There is no reservoir in our village, so we have to use water carefully, especially for household needs and farming," directly establishes the community's high vulnerability to climate change, rooted in a critical deficit of coping resources, particularly water infrastructure. This vulnerability is highly gendered, as housewives, being the primary managers of water for sanitation, cooking, and consumption, disproportionately bear the resulting burden. The lack of water infrastructure (Code: *Lack of water infrastructure*) translates into a substantial increase in the time and physical energy women must expend, thereby significantly elevating their sensitivity to drought conditions. Furthermore, the community's contextual exposure is magnified by its location on the slopes of the Menoreh Hills, making it inherently susceptible to dry-season water stress and heavily reliant on erratic rainfall patterns. This geographical and infrastructural combination renders the existing minimal water supply systems critically insufficient for effective supply management under shifting climatic conditions, solidifying the theme of Water scarcity as a major agricultural risk (Biswas et al.,2024).

The primary climate risk faced by the community stems from the fundamental disruption of established climatic norms, as captured by the statement, "Sometimes our harvest cannot be predicted. The rainy season and dry season no longer follow the usual pattern." This observation of unpredictable seasons (Code: *Unpredictable seasons*) signifies a shift from manageable climate hazards to systemic Climate variability and harvest uncertainty (Theme), which is the principal risk factor undermining agricultural planning and expected financial returns. This environmental risk is quickly transformed into a tangible socio-economic crisis, compounded by the subsequent impact: "When drought comes, our yields decrease and food becomes more expensive. We have to save on daily needs." This highlights

the Compounded Economic Stress leading to Food insecurity. The simultaneous phenomena of Declining yields and rising costs (Code) exert extreme pressure on the household economy. Consequently, women, in their crucial role as household resource managers, are compelled to implement severe consumption adjustments or strategic trade-offs. Such as diverting funds from health or education effectively transforming the environmental risk into a palpable social and nutritional risk (Utami dan Antik, 2025).

The adaptive capacity, which is essential for building long-term resilience, is significantly constrained, as revealed by the excerpt: "Most of us women only help in farming but do not really know advanced techniques. We just follow what our parents used to do." This indicates a critical technical and educational barrier, where the presence of Limited farming skills (Code) restricts women's contributions largely to traditional labor rather than engagement with sophisticated, climate-resilient techniques. This technical gap means that despite women's centrality to household food production, their ability to innovate and adapt to the new climatic reality is severely hampered by reliance on inherited practices that are demonstrably failing under current conditions. This leads directly to the theme of Low adaptive capacity in agriculture. Fundamentally, true resilience necessitates a robust learning and adoption loop for new strategies; the identified lack of technical knowledge inhibits this loop, rendering the community's continued dependence on traditional, vulnerable practices economically and ecologically unsustainable in the long term. In conclusion, the data demonstrates that Ngargoretno's housewives face an interconnected system of gendered vulnerability (water burden), acute climate risk (unpredictable harvests and price hikes), and constrained adaptive capacity (technical knowledge deficit). These findings collectively underscore the urgency for targeted interventions that empower women with the necessary infrastructure and technical skills to transition from merely *coping* with climate stress to actively building long-term resilience (Udumann et al., 2024).

1.2. Risk of Housewives in Ngargoretno Village to Climate Change

The risks faced by women in Ngargoretno Village as a result of climate change are multifaceted, encompassing ecological, economic, and social dimensions. These risks are manifested in the form of water scarcity due to the absence of adequate infrastructure, unpredictable seasonal patterns that disrupt planting and harvesting cycles, and the limited agricultural skills among women that constrain their adaptive capacity. Collectively, these factors heighten the likelihood of declining agricultural yields and increasing household expenditures on food, thereby escalating the risk of food insecurity. The intersection of these risks demonstrates how climate change not only undermines agricultural productivity but also threatens the overall well-being of women and their households in rural mountain communities.

Risk factors are closely interrelated with vulnerability. The vulnerability of a particular region or area is strongly associated with its ecological and social conditions (Subiyanto et al., 2020). Based on the results of interview analysis, several

risks have been identified as consequences of the climate crisis. These include water scarcity, increasing difficulty in determining harvest schedules due to unpredictable rainfall, and the occurrence of landslides. As one participant observed: *"In the past, Ngargoretno Village never experienced landslides. But now they occur, perhaps also because of climate change"* (PO). Drawing on the information from several informants, it is evident that Ngargoretno Village has faced numerous risks arising from climate change in recent years. Among these, the most significant impacts have been on agriculture. Climate change has made harvest seasons increasingly unpredictable, which in turn undermines food security within the village.

Table 2. Theming and Coding of Risk

Interview Excerpt	Code	Theme
"The rainy and dry seasons no longer follow the usual pattern, so we cannot predict the harvest." (Women Farmer)	Changes in climate patterns	Climate variability and uncertainty
"In the past, Ngargoretno Village never experienced landslides. But now they occur, perhaps also because of climate change." (Head Village)	High susceptibility to landslides	Ecological hazards
"Sometimes food becomes more expensive when our harvest fails, and it feels like food is becoming scarce." (Housewives)	Food scarcity	Threats to local food availability
"Sometimes our crops fail because the rain does not come as expected." (KWT)	Crop failures	Agricultural instability
"When yields decrease, our household income also declines, and we struggle to meet expenses." (Housewive)	Loss of household income	Economic vulnerability
"We often struggle with a lack of water. There is no reservoir in our village, so we have to use water carefully." (KWT)	Water crisis	Resource scarcity
"When drought comes, our yields decrease and food becomes more expensive. We have to save on daily needs." (KWT)	Household food insecurity	Threats to food security and welfare

Source: Primary Data (Conducted by Researcher)

The results of the coding and theming process reveal that women in Ngargoretno Village face multiple risks associated with climate change, which are closely linked to both environmental hazards and socio-economic vulnerabilities. The interviews highlight that changes in climate patterns have made the rainy and dry seasons increasingly unpredictable, leading to irregular harvest cycles and heightened uncertainty in agricultural production. In addition, the village has become more susceptible to landslides, a phenomenon not previously experienced but now occurring with greater frequency, which underscores the ecological hazards faced by the community. Food scarcity also emerges as a significant hazard, as respondents noted that crop failures often result in rising food prices and limited local food availability.

These hazards translate directly into risks that undermine household well-being. Crop failures were frequently reported by respondents, resulting from unpredictable rainfall and prolonged droughts, which reduced agricultural yields. Consequently, households experience a loss of income, as declining yields directly affect their economic stability and capacity to meet essential expenses. The issue of water scarcity is also critical; the absence of reservoirs or adequate water storage infrastructure forces families to manage limited resources carefully, intensifying household burdens, particularly for women. Finally, the combined impact of these risks manifests in household food insecurity, as declining yields, rising food prices, and water shortages converge to reduce both food access and affordability.

Taken together, these findings demonstrate how ecological hazards such as climate variability, landslides, and water scarcity intersect with social and economic vulnerabilities to heighten the risks faced by women and households in Ngargoretno Village. These risks not only threaten agricultural productivity but also place additional strains on household food security and livelihoods, reinforcing the need for climate adaptation strategies tailored to rural communities.

1.3. Resilience of Housewives in Ngargoretno Village to Climate Change

Resilience emerges from the vulnerabilities and risks experienced by a community. In this study, such dynamics are evident in Ngargoretno Village. Environmental changes have been occurring in the village since the early 2000s, prompting the community to realize the necessity of adaptation strategies to preserve the natural environment. As one of the local environmental activists, Mr. Shoim explained during an interview: *"To adapt, we practice conservation here. The forms of conservation we undertake are twofold: planting and protection. Planting involves cultivating trees that can provide both economic and food potential, while protection focuses on safeguarding the marble-rich areas."* (PS)

Moreover, the conservation initiatives specifically prioritize the involvement of women, particularly housewives whose husbands work as farmers. This focus is grounded in the recognition that women play a crucial role in ensuring household food security while simultaneously implementing conservation practices at the

household level. As Mr. Shoim further noted: *"It is very easy to mobilize women because they actively participate in many community groups such as PKK, Women Farmer Groups (KWT), Dasa Wisma, and even religious study groups. This makes the approach quite effective."* (PS)

The existence of women's associations or community groups facilitates the implementation of resilience strategies. This is because such groups are already bound by a strong sense of solidarity and shared responsibility, making it easier to organize and execute collective programs. Furthermore, resilience strategies in Ngargoretno Village are directed toward two primary objectives: safeguarding food security and enhancing the community's economic functions as part of efforts to improve overall well-being. These objectives are pursued beginning at the smallest unit, namely the household, with women, particularly housewives serving as the central actors in driving change and adaptation.

Table 3. Theming and Coding of Resiliences

Interview Excerpt	Code	Theme
"We use our home gardens to grow secondary crops such as cassava and maize, and we also store maize as an alternative to rice."(KWT)	Utilizing household yards and storing maize as rice substitute	Enhancing food security
"We try to diversify our crops so that if one fails, we still have another source of food." (PS)	Crop diversification to reduce dependency	Enhancing food security
"Women here plant bamboo, which is later crafted into handicrafts that can be sold." (PS)	Bamboo planting and processing into handicrafts	Economic empowerment and environmental conservation
"We also conduct reforestation activities to restore degraded areas." (KWT)	Reforestation initiatives	Economic empowerment and environmental conservation
"Part of our agricultural products are processed into local souvenirs for tourists." (KWT)	Processing agricultural products into value-added goods	Economic empowerment and environmental conservation

Source: Primary Data (Conducted by Researcher)

The findings reveal that resilience in Ngargoretno Village is constructed through two interconnected strategies: enhancing food security and promoting economic empowerment combined with environmental conservation. These

strategies emerge as adaptive responses to the vulnerabilities and risks caused by climate change, particularly the challenges of water scarcity, unpredictable harvests, and declining agricultural productivity.

First, the community enhances food security primarily through household-based practices. Women play a central role in utilizing home gardens to cultivate secondary crops such as maize and cassava, which provide alternative sources of staple food. In addition, maize is often stored as a substitute for rice, reflecting an adaptive approach to managing food shortages. Crop diversification also serves as a critical measure to reduce dependency on a single crop, thereby ensuring that families maintain access to food even when certain harvests fail. These practices demonstrate a bottom-up resilience strategy that begins at the household level and collectively strengthens village-wide food security.

Second, resilience is also shaped by initiatives that combine economic empowerment with environmental conservation. Women are actively engaged in bamboo cultivation, which serves a dual purpose: preventing soil erosion on the mountain slopes and providing raw material for handicrafts that generate additional household income. Reforestation activities are likewise carried out to restore degraded lands and improve ecological stability. Furthermore, a portion of agricultural produce is processed into value-added products marketed as local souvenirs, thereby linking agricultural resilience with tourism-based economic development.

Together, these strategies illustrate that the resilience of Ngargoretno Village is not solely about survival but also about transformation. By integrating food security practices with economic and ecological initiatives, the community—particularly women—plays a pivotal role in fostering a sustainable adaptation model that addresses both immediate household needs and long-term environmental challenges.

1.3.1 Women's Adaptation as an Effort to Enhance Household Food Security

In Ngargoretno Village, women's adaptation strategies play a pivotal role in strengthening household food security amidst the challenges posed by climate change. As primary managers of household consumption and active contributors to agricultural practices, women are directly involved in ensuring food availability and stability for their families. Their adaptive efforts are manifested through various practices, such as utilizing home gardens for cultivating secondary crops, diversifying agricultural production, and storing alternative food sources to mitigate the risks of harvest failure. These strategies demonstrate not only women's agency in sustaining household resilience but also their critical contribution to the broader community's capacity to withstand climate-induced food insecurities.

"There are various programs aimed at improving food security. For example, we, as women, are required to plant vegetables around our homes and store maize to be processed as a substitute for rice, particularly in case of delays in the rice harvest." (ID – KWT)

"In addition, we also plant bamboo, the shoots of which can be consumed as food or sold for additional income. Moreover, every household is required to raise livestock such as goats, cattle, or chickens. The manure from these animals can later be processed into fertilizer for agriculture." (IJ – PKK)

As an adaptation strategy to strengthen household food security, women in Ngargoretno Village utilize the land surrounding their homes to cultivate vegetables. The planting and maintenance of these crops are carried out individually by women in their respective households. They also grow tubers as an alternative to rice, serving as a mitigation measure in case of harvest failure or delayed harvests. Furthermore, women engage in bamboo cultivation, where the shoots provide both a food source and a potential commodity for sale. Notably, each household is required to keep livestock such as chickens, goats, or cattle not only as a form of savings that can be sold in times of financial need, but also to produce manure that can be used as organic fertilizer for rice fields or household vegetable gardens. These strategies demonstrate the proactive role of women in maintaining food security amidst climate change pressures. Women in Ngargoretno also receive training on home-based cultivation and land utilization through local women's organizations such as PKK, the Women Farmers' Group (KWT), and Dasa Wisma, which further enhances their adaptive capacity.

1.3.2 Women's Adaptation as an Effort in Economic Empowerment and Environmental Conservation

In addition to efforts aimed at maintaining food security, women in Ngargoretno Village have also begun engaging in environmental conservation as a strategy to mitigate the impacts of climate change–induced environmental degradation. Several conservation practices have been implemented, including reforestation initiatives, preserving the natural landscape, and refraining from indiscriminate tree cutting.

Furthermore, women have initiated bamboo cultivation, which serves multiple purposes: the bamboo is utilized as raw material for handicrafts, while its shoots can be processed into food products. Agricultural produce from Ngargoretno Village is also transformed into souvenirs, aligning with the village's identity as a tourism destination. These innovations are expected to contribute not only to environmental sustainability but also to the improvement of the local community's economy.

Discussion

The findings of this study reveal that women in Ngargoretno Village face multiple vulnerabilities as both housewives and agricultural workers. The unpredictability of seasons, declining water availability, and lack of agricultural infrastructure significantly threaten household food security. These conditions are consistent with recent studies in East Java, which demonstrate that climate variability and rainfall uncertainty undermine agricultural productivity and increase farming

risks (Atasa, Widayanti, Laily, & Toiba, 2024). In Ngargoretno, the situation is exacerbated by women's limited access to advanced farming skills and the absence of water storage facilities, reflecting low adaptive capacity. Such vulnerabilities mirror the challenges identified by Samputra and Antriyandarti (2024) in West Sleman, where women farmers also reported food insecurity due to water scarcity and unpredictable harvests.

The risks emerging from these vulnerabilities include harvest failures, income loss, and heightened household food insecurity. Informants reported that landslides, previously uncommon in Ngargoretno, have become more frequent, aligning with broader evidence that climate change intensifies environmental hazards in rural Indonesia. Women's experiences of declining yields and rising costs resonate with findings from rural Java, where women shoulder the dual responsibility of ensuring household food supply while contributing to agricultural labor under increasingly unstable ecological conditions (Antriyandarti, Nawang Suprihatin, Pangesti, & Samputra, 2024). These overlapping risks demonstrate how closely ecological and social dimensions are intertwined in shaping local climate vulnerability (Subiyanto et al., 2020).

Despite these challenges, women in Ngargoretno exhibit considerable resilience. Adaptation strategies include utilizing home gardens to plant vegetables and tubers, storing maize as a substitute for rice, and diversifying agricultural products to mitigate risks of harvest loss. Such practices are consistent with women's adaptation strategies in swamp-based communities in Indonesia, where diversification and household-level food production are key to maintaining food security (Yunindyawati, Lidya, Rinto, & Azni, 2025). Furthermore, women play an active role in conservation initiatives such as bamboo planting, reforestation, and the processing of agricultural products into souvenirs for eco-tourism markets. These activities not only contribute to environmental protection but also enhance household income opportunities, echoing evidence from agroforestry systems in Indonesia where livelihood diversification strengthens resilience under climate change (Sudomo et al., 2023).

Importantly, women's participation in community groups such as PKK, Women Farmer Groups (KWT), and Dasa Wisma facilitates collective adaptation and conservation practices. The existence of such groups provides a social infrastructure that enables rapid mobilization and shared responsibility, making resilience strategies more sustainable. This finding aligns with broader research that emphasizes the pivotal role of women's organizations in advancing food security and adaptation in rural contexts (Antriyandarti et al., 2024). Overall, the resilience strategies observed in Ngargoretno demonstrate how women's agency at the household and community levels can significantly contribute to sustaining livelihoods, ensuring food security, and promoting ecological conservation in the face of climate change.

Conclusion

The majority of women in Ngargoretno Village serve as housewives while simultaneously assisting their husbands in agricultural activities, with the main commodities including rice, cloves, cardamom, and secondary crops. However, agriculture in the village faces serious challenges due to climate change, which has led to irregular seasons, water shortages, and unpredictable harvest schedules. These conditions pose a significant threat to local food security, as they reduce agricultural productivity and increase the risk of crop losses. Furthermore, the limited farming skills of housewives and the absence of water storage facilities exacerbate existing vulnerabilities. Consequently, the prudent management of water resources and the strengthening of community capacity particularly among women are essential to reinforcing food security and ensuring agricultural sustainability in Ngargoretno Village. Ngargoretno Village also faces multiple risks closely tied to its ecological vulnerabilities under climate change. The primary risks include water scarcity, increasingly unpredictable harvest schedules caused by irregular rainfall, and a growing incidence of landslides, an environmental hazard that was previously absent in the area.

Women's resilience strategies are primarily centered on household food security. These include utilizing home gardens for vegetable cultivation, storing maize as an alternative staple, and processing agricultural products into souvenirs for sale in local tourism markets. Such practices not only strengthen household resilience but also contribute to the integration of agriculture with the village's growing tourism sector. Based on these findings, this study recommends that government stakeholders strengthen partnerships with Ngargoretno Village to enhance the implementation of conservation practices. Such collaborations would not only support local adaptation to climate change but also improve the sustainability of both livelihoods and ecosystems in the village.

Declarations

The authors conceived and designed the study, conducted fieldwork, collected and analyzed the data, and drafted the manuscript. The author approved the final version of the manuscript for submission.

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Data availability statement

The data supporting the findings of this study are available from the corresponding author upon reasonable request. Due to ethical considerations and confidentiality agreements with participants, interview transcripts are not publicly available.

Declaration of interests statement

The author declares no known competing financial interests or personal relationships that could have influenced the work reported in this paper.

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