Is there any gender difference in environmental concern? Evidence from the smallholder farmers in Oromia regional state of Ethiopia

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Abstract: Understanding and closing the gender gap in environmental concern is the only way to identify and implement the best policies for the environment and sustainable development. This paper examines the gender difference in environmental concern in the case of Ethiopia, Oromia regional state. For this, 140 individuals are sampled from the study areas. The result reveals that women play triple role in their communities: reproductive role, productive role, and community roles. The result also shows that women are more likely to depend on natural resources and hence more likely vulnerable to climate change effects. However, there is no statistically significant difference between women and men in terms of climate change awareness and choice of climate change adaptation strategies. The estimated logit model predicts that women are 31.25 times more likely to participate in environmental conservation than men. Increase in the daily work load by 1 hour is more likely to reduce the individual participation in environmental conservation by 0.237 times. The result also shows that increase in livestock possession decreases individual participation in environmental conservations. A number of policy implications are drawn. There is a need to increase the incentive and distribution of improved cooking stoves and biogas so as to decrease the women work loads. There is also a need to engage civil society organizations, government institutions, and relevant women’s networks to ensure inclusive approaches to the implementation of gender-responsive forest policies. Finally, the regional government is advised to organize gender-awareness seminars and workshops for forestry officials, including decision-makers and policy committee members.

Subjects: African Studies; Statistics for Social Sciences; Education; Gender Studies - Soc Sci; Urban Studies; Urban Economics; Environmental Psychology; Feminist Psychology

Keywords: adaptation strategy; climate change; gender difference; vulnerability; work load

1. Introduction
Understanding the gender-environment nexus is critical for analyzing social and environmental disparities and barriers to sustainable development. Such understanding is also inevitable for unlocking revolutionary action possibilities (Dhenge et al., 2022; Perez et al., 2015; UN, 2021a). Evidences shows that women and men experience the effects of climate change differently, contribute to environmental degradation and conservation in different ways, and face different levels of disaster preparedness and capacity (UN, 2021a). The problem is further exacerbated by...
women's lack of access to economic resources, education, and legal rights. Gender disparities in land rights are common. Women not only have less access to land than men but also are frequently limited to so-called secondary land rights obtained through men's family members (UN, 2021a). They also own less property than men, and the land they do own is frequently of worse quality, and their tenure is precarious (Perez et al., 2015). Women have less access to common property resources and cash to purchase goods and services than men do.

In families, societies, and cultures, men and women have different roles and duties. This different roles and duties influence the attitude of men and women differently. According to their perceived environmental protection experience, they are involved in environmental conservation differently (Dhenge et al., 2022). In terms of environmental activities, a positive gender attitude is critical. As a result, when considering environmental conservation, the importance of gender attitudes should not be overlooked. Understanding and closing the gender gap in environmental concern is the only way to identify and implement the best policies for the environment and sustainable development. However, there is a scarcity of trustworthy data available to decision makers on gender disparities and attitudes toward environmental conservation in less developed countries like Ethiopia (UN, 2021a). The full range of interconnections between gender and environmental goals has not been made sufficiently visible or prioritized in various sectors, including agriculture (OECD, 2021). This paper aims to address these literature gaps. Specifically, the paper identifies gender-based difference in labor divisions in rural areas and how such labor division affects their environmental concern; gender difference in climate change awareness; and gender difference in vulnerability to climate change and how such differences affect their adaptation strategies and overall gender difference in environmental concern.

The remainder of the article is structured as follows: Section 2 presents literature review followed by Section 3 providing research methods for the study. Section 4 presents the discussion of the econometric results, and Section 5 presents the conclusions and policy implications of the study.

2. Literature review
A number of studies show that women report moderately stronger environmental concern than men (Abbasi et al., 2019; Burke, 2019; Dhenge et al., 2022; Duchelle et al., 2014; McCright & Xiao, 2014; Sundström & McCright, 2014; Villamor et al., 2014). These studies were carried out based on a number of theories. The first widely investigated theory is gender socialization. According to this theory, men and women are socialized respectively into masculine and feminine identities and hence differ on key beliefs and values that directly influence environmental concern (McCright & Xiao, 2014). The theory suggests that boys learn that masculinity means being competitive, independent, and unemotional and entails objectively exerting mastery and control over other people and things (Dhenge et al., 2022; Gökmen, 2021; OECD, 2021; Strapko et al., 2016). As a result, boys realize they are expected to economically provide for their family when they grow up and become fathers. On the contrary, girls learn that femininity means being compassionate, cooperative and empathetic and entail connecting with other people and expressing concern about their well-being. This means girls realize they are expected to enact an ethic of care as a nurturing caregiver when they grow up and become mothers. In short, a masculine identity emphasizes detachment, control and mastery, while a feminine identity stresses attachment, empathy and care (Dhenge et al., 2022; UN, 2021a).

The second theory widely investigated is gender role. The theory focuses on the influences of the social roles that men and women differentially perform as adults (McCright & Xiao, 2014; Xiao & McCright, 2015). This gender role theory is basically emanated from the gender socialization theory described above. Because women and men are socialized differently, they reflect different experiences, competencies, interests and dispositions that come from performing (and being socialized to perform) these different roles (Sithole et al., 2021). Eventually, men and women basically differ on productive activities, reproductive activities and community work activities. Evidences show
that conventional gender socialization leads men to internalize a “marketplace mentality” and women to internalize a “motherhood mentality.” In other words, women are mainly pre-occupied by unpaid reproductive activities while productive paid and activities and community works are mainly the domain of the men (Ampaire et al., 2020; Sihole et al., 2021). This may imply that men are socialized to favors economic growth and exploitation of natural resources for personal benefit while the women are socialized to favors protection of nature and other species (Xiao & McCright, 2015). The other line of argument which is basically related to gender role states that “women’s limited biographical availability (e.g., parenting or carrying out housework while also working outside of the home) reduces their opportunities to engage in public behaviors—regardless of their greater environmental concern compared with men” (Xiao & McCright, 2015).

Despite increasing research on gender difference in environmental concern, findings are far from convergence (Xiao & McCright, 2015). While early literatures on environmental concern in the 1960s and 1970s tended to find little evidence of a gender difference (Xiao & McCright, 2015), research attempts during 1990s show that women report stronger pro-environmental values, beliefs, and attitudes than do men (Xiao & McCright, 2015). Over the last couple of decades, available evidences are mixed and location specific (Sundström & McCright, 2014). Moreover, studies are confined mainly to North American and European countries while the less developing country cases are receiving scanty attentions (Dhenge et al., 2022; Gökmen, 2021). However, we are aware of a study by Tesso (2014), who examined gender difference in vulnerability to the occurrences of climatic extremes with a survey of 452 individuals conducted in the central part of Ethiopia using time series data of climate variability and its impacts on livelihood. According to this study, women experience more vulnerable climate changes than men respondents. According to this study, women are marginalized as compared to men in terms of average farmland owned; average number of farm plots; average area under irrigation; average who do not own oxen; and average livestock ownership and hence more likely to be vulnerable to climate changes than men. Nevertheless, this study failed to examine the gender difference in terms of climate change awareness, adaptation mechanisms, and overall environmental concern. Thus, we are not aware of any research attempt to examine the relationship between gender and environmental concern among smallholder farmers in developing countries in general and in Ethiopia in particular. More importantly, those research attempts in the developed countries focused on either gender socialization theory or gender role theory separately. None of them has attempted to investigate both theories simultaneously. Thus, in this research, we have examined gender difference in environmental concern taking case of smallholder farmers in Ethiopia while exploiting the well-established theories explained above. To be more succinct, this research aims to fill the existing context and theoretical gaps in the current literature.

3. Research methodology

3.1. Description of study area

This study was carried out in smallholder farmers in Oromia, Ethiopia. The Oromia Region state is one of the nine regional states of Ethiopia, the homeland of the Oromo. It is bordered by the Somali Region to the east; the Amhara Region, the Afar Region, and the Benishangul Gumuz Region to the north; South Sudan, Gambella Region, and South Nations Nationalities and Peoples Region to the West; and Kenya to the south. From Oromia regions, West Arsi and West Guji Zones are selected. West Arsi zone has 15 Woredas and its Zone capital is Shashemene. Shashemene is 254 km and Bule Hora is 470 km from the capital city of Ethiopia, Addis Ababa. West Guji has 12 Woredas and its capital is Bule Hora. Dodola and Adaba Woredas from West Arsi and Bore and Adola Rede Woredas² from West Guji Zone are selected for this study.

3.2. Study design and data collection procedures

The sample was determined using multistage cluster sampling design. Multistage sampling refers to sampling plans where the sampling is carried out in stages using smaller and smaller sampling units at each stage (Kothari, 2004). In this case, a sample of primary units is selected and then
a sample of secondary units is selected within each primary unit. Accordingly, zones are our primary sampling unit. By the time this research proposal was conducted, there were 20 Oromia zones. At the moment, the Oromia National Regional State Forested Landscape Project (OFLP) classifies Oromia zones into two based on their deforestation status. Accordingly, 7 zones are classified as hotspot zones while the remaining 13 are classified as non-hotspot zones (OFLP, 2017). The deforestation hotspot areas include Bale zone, East Guji Zone, West Guji zone, Borana zone, Illu Ababora zone, Bedele zone, and Kelam Wollega zone. The rest of the zones are classified as deforestation non-hotspot zones. Accordingly, West Guji zone and West Arsi zones were selected from hotspot and non-hotspot zones, respectively.

Districts (Woredas) in each zone were considered as the secondary sampling unit. Following similar logic as for the selection of the zones, districts are grouped into two as hotspot districts and non-hotspot districts. Accordingly, 85 of 250 rural districts, 52 districts are already classified as hotspot districts for forest management investment in deforestation by OFLP. The rest of the districts are non-hotspot for forest management investment in deforestation. Accordingly, two districts from each hotspot zones and non-hotspot zones were sampled using probability method, thereby making a total of four districts. Of these, two districts are from the hotspot zone while the remaining two are from non-hotspot zones. Kebeles are within each district were considered as third sampling unit. Two Kebeles from each district were selected in consultation with the respective district-level natural resources management development agents. This makes a total of eight Kebeles from four districts. The final sampling unit is individuals within each Kebele.

The size of the sample of any infinite population can be determined by the formula specified by (Kothari, 2004, p. 179) as follows:

\[ n = \frac{Z^2 \cdot p \cdot q}{e^2} \]

Where

- \( p \) = proportion of the population meeting specific requirements, \( q = 1 - p \);

- \( Z \) = the value of the standard variate at a given confidence level

- \( n \) = the desired sample size

- \( e \) = the desired precision level

In this case, the author has used 95% confident that the estimated sample statistic to be within ±7% of the true value (population parameter). This means the z-value would be 1.96 and the precision level (e) is 7%. Moreover, in order to determine the sample size, the value of \( p \) and \( q \) need to be determined. In the absence of any pilot test or prior research in the area, the best method may be to take the value of \( p = 0.5 \), in which case “n” is the maximum and the sample will yield at least the desired precision. This will be the most conservative sample size. In this research case, however, the value of \( p \) and \( q \) can be accessed from prior research in the area. Evidence shows that the participation rate of women in natural resources management in Oromia region is about 24% while men’s participation is relatively higher (OFLP, 2017). Thus, the value of \( p \) can be safely considered as \( p = 0.24 \) and hence \( q = 1 - p \), which is 0.76. By substituting these values in the above formula, we get sample size of:

\[ n = \frac{(1.96)^2 \cdot 0.24 \cdot 0.76}{(0.07)^2} = 144 \]

The next issue is how to determine which specific individual to include in the sample from each Kebele. As the objective of the research was to analyze gender difference in environmental
concern, we wanted to ensure fairly proportional representation of women-headed and men-headed households in the survey. However, as the number of women-headed individuals within each Kebele is significantly small compared to the men-headed households, we have deliberately oversampled women-headed households so as to enable gender disaggregated data analysis. In order to minimize the potential statistical inference bias ensuing from oversampling of women-headed households, we have adjusted the data using sampling weight during our data analysis. Accordingly, we have sampled eight women-headed and 10 men-headed households from each Kebele using simple random sampling, thereby making total sample size of 144 \( (18 \times 8 = 144) \). However, four questionnaires were discarded because of missing information on important variables. Thus, the effective sample size was 140 as depicted by the following Table 1.

Quantitative data was generated using questionnaire on economic information like income and expense levels; assets such as productive assets, land tenure, agriculture and livestock, access to infrastructure, access to training and education, skills individual labor availability, membership in community groups, financial services such as savings and access to credit; livelihood strategies include number and type of activities, farm, non-farm, off-farm, income by source, access to rural assets, and seasonal variation in strategies and the impact of shocks on the individual assets, indicators of livelihood security and demographic characteristics of individuals.

Parallel with the quantitative survey, we have conducted qualitative research. The aim of this qualitative research was to capture knowledge, attitude, practices as well as the nature of social sanctions and their enforceability in the community with regard to promoting gender equality. In short, the aim of FGD was to get in-depth understanding of any existing opportunities and constraints to equal gender participation in reproductive activities, productive activities and community activities. Accordingly, we have conducted one FGD at each Kebele consisting of 8–12 individuals.

3.3. Conceptual framework of the study
This conceptual framework is constructed based on a number of theories explained in the literature review section above. The following Figure 1 depicts the interdependence and interaction of these theories.

For more discussions on the interdependence among factors in the conceptual framework, see Xiao and McCright (2015).

3.4. Model specification
In this research, the Logistic regression model is applied. Logistic regression, also called a logit model, is used to model categorical outcome variables. In the logit model, the log odds of the
outcome is modeled as a linear combination of the predictor variables. Because the linear regression model is used only when the dependent variable is continuous, logistic regression (probit regression) is used for modeling where the dependent variable is discrete. In this study, the dependent variable (participation in afforestation program of 2019) is a dummy variable. In this case, the value takes 1 if the individual has participated in 2019 afforestation program and 0 otherwise. The logistic regression model binary logit model is modeled as follows (Verbeek, 2017).

\[ P_i = E(Y = 1/X_i) = \frac{1}{1 + e^{-Z_i}} \]  

(1)

Where \( Z_i = \beta_0 + \beta X_{i}, \) \( Z \) represents Logistic Distribution Function. Thus, the probability that a given individual is participant in the afforestation program during 2019 is given by:

\[ P_i = \frac{1}{1 + e^{-Z_i}} \]  

(2)

If \( P_i \) is the probability of an individual participating in the afforestation program, then \( 1 - P_i \) is the probability of the individual not participating in the program. Thus, the probability that a given individual did not participate in the afforestation program is given by

\[ 1 - P_i = \frac{1}{1 + e^{Z_i}} \]  

(3)

Thus, the ratio of the probability that a given individual is a participant in the program to the probability that the same he/she is not participant in the program is given by

\[ \frac{P_i}{1 - P_i} = \frac{1 + e^{Z_i}}{1 + e^{-Z_i}} \]  

(4)

Changing both sides to the natural logarithms, we can get linear equation:

\[ L_i = \ln \left( \frac{P_i}{1 - P_i} \right) = Z_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_n X_n \]  

(5)

Where;

- \( L_i \) = the log of the odds ratio, which is linear in both \( X_i \)’s and parameters.
- \( P_i \) = the probability of an individual participating in afforestation program ranging from 0 to 1.
- \( 1 - P_i \) = is the probability of a given individual not participating in the program.
- \( Z_i \) = is a function of an explanatory variable \( X \), expressed as \( Z_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_n X_n \)
- \( \beta_0 \) = is an intercept, and \( \beta_1, \beta_2 \ldots \beta_n \) are the slopes of the function.

In general, the logistic regression model including the disturbance term can be expressed as

\[ Z_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots + \beta_n X_n + \epsilon_i \]  

(6)

\( X_i \) = is the vector of explanatory variables (predictors) and \( X_1 \ldots X_n \) represent major factors influencing individual participation in the afforestation program considered as independent variables with coefficient parameters of \( \beta_0, \beta_1, \beta_2 \ldots \beta_n \) and the \( \epsilon_i \) error term.

### 3.5. Variable definitions and measurements

**Dependent Variable:** The dependent variable in this model is binary variable in which 1 stands for participant individuals in 2019 afforestation/re-afforestation program and 0 otherwise.
Independent variables: The dependent variable is influenced by a number of explanatory variables. These include age of individuals, sex, family size, availability of labor force, religion of individuals, dependency ratio, income, workload, livestock possession, membership to cooperatives, access to information, environmental views, and others (Table 2). Aging is associated with a process of decline in economic, social and physical terms, and hence as individuals get more aged, their participation in environmental conservation is expected to decline (Mazurana et al., 2013). Because women have a longer biological life expectancy than men, it is younger women who are more likely to have more social networks and hence more likely to participate in environmental conservation than the older ones (Mazurana et al., 2013; Supriya Akerkar, 2022).

4. Results and discussion

4.1. Descriptive analysis

4.1.1. Demographic and socioeconomic characteristic of individuals
Descriptive analysis includes demographic and socio-economic characteristic of sampled individuals by sex, age, household size, education level, marital status, livestock holding, land holding, work burden, and others, which are summarized in relation to the sex of the individuals. Table 3 shows details of socio-demographic variables.

As reported in the table, most of the individual characteristics were significantly different across sex of the individuals. With the exception of daily workload and distance traveled for firewood collection, men have the highest scores in all terms. Contrary to the expectation, men are more aged as compared to women. Similarly, the men are better educated, have more family members, and have more productive labor force than the women. In contrast, women are identified with statistically higher workload per hour and travel more distance for firewood collection.

Significant differences are also observed in terms of literacy and saving. Men are more likely to be educated and have more saving as compared to women. This result is also consistent with growing body of literature in the field (Olalekan, Monsurat, et al., 2019; Huluka et al., 2019). The following table 4 depicts the details.

In general, while men are identified with statistically significant higher difference in human assets, females are identified with statistically significant higher difference in terms of workloads. This finding is consistent with other literatures (McCright & Xiao, 2014; Sundström & McCright, 2014; Olalekan, et al., 2019).

| Survey Zones | Survey districts | Survey Kebeles | Sex of the respondents |
|--------------|-----------------|----------------|------------------------|
|              |                 |                | Women | Men | Total |
| West Arsi    | Dadola          | Barisa         | 3     | 16  | 19    |
|              |                 | Danaba         | 10    | 7   | 17    |
|              | Adaba           | Bucha          | 11    | 6   | 17    |
|              |                 | Weshà          | 9     | 8   | 17    |
| West Gusji   | Adola Rede      | Bake Bulala    | 2     | 17  | 19    |
|              |                 | Adama Dhiba    | 9     | 8   | 17    |
|              | Bore            | Ana Wate       | 8     | 9   | 17    |
|              |                 | Eshado Aleya   | 10    | 7   | 17    |
|              |                 |                | 62    | 78  | 140   |
| Variables       | Definition of variables                                      | Measurement of the variables                  | Expected sign |
|-----------------|-------------------------------------------------------------|-----------------------------------------------|---------------|
| Participate     | Participation in afforestation/ re-afforestation program     | 1 = if participated, 0 = otherwise            |               |
| Sex             | sex individual                                              | 1 = men, 0 = women                            | -             |
| Age             | Age of individual                                            | Years of age (continuous)                     | +             |
| Marital         | Marital status of respondent                                | 1 = Married, 0 = otherwise                     | ±             |
| Literacy        | Literacy (can read and write)                               | Yes = 1, No = 0                               | +             |
| Religion        | Religion of the individual                                   | 1 = Muslim, 0 = Otherwise                      | ±             |
| Zone            | Survey zone                                                 | 1 = West Arsi, 0 = West Guji zone              |               |
| Fmsize          | Individual size                                             | Individual members of the individual s        | +             |
| Active labour   | Member of household 15–64 years                             | Number of members within the age              | +             |
| Farmers         | Members of households with full-time employment in agriculture | Number of members                            | +             |
| Dependent       | Household members below 15 and above 64 years of age         | Number of members                            | +             |
| Income          | Estimated annual individual income                           | Birr                                          | +             |
| Land            | Possession of land                                          | 1 = Yes, 0 = Otherwise                        | +             |
| Distance        | Walking distance to collect firewood                        | In hours                                     | -             |
| Work load       | Workload per day                                            | In hours                                     | -             |
| Climate         | Awareness about climate change?                             | 1 = Yes, 0 = Otherwise                        | +             |
| Deforestation   | Awareness about consequence of deforestation                | 1 = Yes, 0 = Otherwise                        | +             |
| Trust in gov’t  | Trust in government law?                                    | 1 = Yes, 0 = Otherwise                        | -             |
| Trust in social institutions | Trust in social institutions           | 1 = Yes, 0 = Otherwise                        | +             |
| environmental view | Willingness to forgo some economic activities for the sake of environmental protection | 1 = Yes, 0 = Otherwise | +             |
| Livestock       | Possession of livestock.                                    | Tropical livestock unit (TLU)                 | +             |
| Coop            | Membership of the respondent to cooperatives                 | 1 = Yes, 0 = Otherwise                        | +             |
| Information     | Access to information about environmental issues             | 1 = Yes, 0 = Otherwise                        | +             |
4.2. Farm and economic characteristics of the individuals

The demographic and social difference between men and women observed may ultimately result in economic achievement differences as well. Thus, it is imperative to see any difference between them in terms of economic achievements. The following table 5 depicts this comparison.

As expected, men have statistically higher economic achievements than women. Men have reported mean annual income of Birr 42,662, while the women report Birr 32,110, and this difference is statistically different. Given the more labor availability and more literacy of the men, this difference is expected. Similarly, men are identified with statistically higher difference in terms of annual expenditures they make, land size holding, and livestock possessions.

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Table 3. Comparison of socio-demographic variables by sex

| Variables                        | Mean of the variables | t-test |
|----------------------------------|-----------------------|--------|
| Individual age (years)           | Men 43.308            | Women 38.403 | t 2.860 | p>|t| 0.005 |
| Education (grade)                | Men 6.8714            | Women 5.6585 | t 2.460 | p>|t| 0.015 |
| Family size                      | Men 9.2436            | Women 7.6452 | t 3.370 | p>|t| 0.001 |
| Active labor (15 to 64 years)    | Men 4.9487            | Women 4.0806 | t 2.810 | p>|t| 0.006 |
| Members engaged in agriculture   | Men 2.2179            | Women 1.7097 | t 3.970 | p>|t| 0.000 |
| Family members below 15 years age| Men 3.2179            | Women 2.4194 | t 2.680 | p>|t| 0.008 |
| Family members aged above 64 years| Men 0.16667           | Women 0.06452 | t 1.850 | p>|t| 0.067 |
| Workload (hours/day)             | Men 9.23              | Women 12.27 | t 0.940 | p>|t| 0.348 |
| Distance for firewood collection (Hours) | Men 1.87          | Women 2.20 | t 2.360 | p>|t| 0.020 |

Table 4. Comparison of social factors by sex

| Variables                        | Women | Men | Total | χ² value |
|----------------------------------|-------|-----|-------|----------|
| Can you read and write?          |       |     |       |          |
| No                               | 20    | 9   | 29    | 20.71    | 0.003    |
| Yes                              | 42    | 69  | 111   | 79.29    |          |
| Total                            | 62    | 78  | 140   |          |          |
| Do you have a saving account in cash? |       |     |       |          |
| No                               | 32    | 21  | 53    | 37.86    | 0.003    |
| Yes                              | 30    | 57  | 87    | 62.14    |          |
| Total                            | 62    | 78  | 140   |          |          |

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as mushroom collection, medicinal plants, and harvesting fodder and spices from the forest. This finding is also consistent with Sithole et al. (2021) who argued that women are more likely to earn income from non-wood forest products. This indicates that men are more likely to participate in deforestation activities than women. This result is also consistent with other prior research reports (Dhenge et al., 2022; Gökmen, 2021; Olalekan, Monsurat et al., 2019; Strapko et al., 2016).

### 4.3. Gender and labor divisions

This section is devoted to the assessment of gender based division of labour. The report is based on the FGD carried out at each of the selected Kebeles. Although there were minor differences in labor division across the zones and districts, only activities and gender divisions that are common across all the survey areas are presented here.

Despite slight variations across the two zones and districts, women’s and men’s roles and responsibilities often follow similar gender divisions of labor. In both zones and almost all districts and Kebeles within those zones, women are predominantly occupied with the reproductive activities. Such activities involve bearing and rearing of children and all the tasks associated with domestic work and the maintenance of all household members. These tasks include cooking, washing clothes, cleaning, collecting water and fuel, and caring for the sick and elderly.

**Table 5. Comparison of economic factors by sex**

| Mean of the variables                                      | Men      | Women    | t        | p>|t| |
|------------------------------------------------------------|----------|----------|----------|--------|
| Estimated annual income (Birr)                             | 42,662   | 32,110   | 3.350    | 0.001  |
| Estimated annual expense (Birr)                            | 30,631   | 24,418   | 2.480    | 0.014  |
| Monthly income from NWFP (Birr)                            | 608      | 1,364    | -4.960   | 0.000  |
| Yearly income from timber products (Birr)                  | 3,682    | 2,413    | 3.000    | 0.005  |
| Individual land size (Hectare)                             | 3.07     | 2.51     | 2.520    | 0.013  |
| Livestock possession (TLU)                                 | 9.93     | 8.44     | 2.450    | 0.016  |

**Table 6. Comparison of frequency of travel to forest by sex**

| Frequency of travel | Women | Men | Total |
|---------------------|-------|-----|-------|
|                     | N     | %   | N     | %   | N     | %   |
| More than once/day  | 8     | 12.9| 2     | 2.56| 10    | 7.14|
| Once/day            | 20    | 32.26| 5    | 6.41| 25    | 17.86|
| Four times/week     | 26    | 41.94| 30   | 38.5| 56    | 40   |
| Once/week           | 6     | 9.68| 20   | 25.6| 26    | 18.57|
| Irregularly         | 2     | 3.23| 21   | 26.9| 23    | 16.43|
| Total               | 62    | 100 | 78   | 100 | 140   | 100 |

Pearson chi-square (4) = 34.7451 Pr = 0.000
### Table 7. Comparison of reasons of travel to forest by sex

| Reasons of travel                              | Sex of the respondents |       |       |       |       |       |
|------------------------------------------------|------------------------|-------|-------|-------|-------|-------|
|                                                |                        | N     | %     | N     | %     | N     |
| For firewood collection                        | Women                  | 16    | 25.81 | 9     | 11.54 | 25    | 17.86 |
|                                                | Men                    | 21    | 26.92 | 21    | 26.92 | 38    | 27.14 |
| For firewood and construction materials        | Women                  | 17    | 27.42 | 17    | 27.42 | 34    | 24.31 |
|                                                | Men                    | 21    | 26.92 | 21    | 26.92 | 42    | 30.00 |
| For firewood, construction, and fodder materials | Women                  | 4     | 6.45  | 6     | 7.69  | 10    | 7.14  |
|                                                | Men                    |        |       |        |       |       |
| Firewood, construction, fodder, and medicinal materials | Women                  | 16    | 25.81 | 7     | 8.97  | 23    | 16.43 |
|                                                | Men                    |        |       |        |       |       |
| For firewood, construction, fodder, medicinal and fruits | Women                  | 8     | 12.9  | 6     | 7.69  | 14    | 10.00 |
|                                                | Men                    |        |       |        |       |       |
| Others (hunting, timber production logging, etc) | Women                  | 1     | 1.61  | 29    | 37.18 | 30    | 21.43 |
|                                                | Men                    |        |       |        |       |       |
| Total                                          | Women                  | 62    | 100   | 78    | 100   | 140   | 100   |
|                                                | Men                    | 78    | 100   | 78    | 100   | 156   | 100   |
|                                                | Total                  | 140   | 100   | 156   | 100   | 396   | 100   |

Pearson chi-square (5) = 31.3021 Pr = 0.000

### Table 8. Comparison of climate change adaptation strategy by sex

| Adaptation strategy used                        | Sex of the respondents |       |       |       |       |       |
|------------------------------------------------|------------------------|-------|-------|-------|-------|-------|
|                                                |                        | N     | %     | N     | %     | N     |
| Changing crop type                             | Women                  | 1     | 1.61  | 5     | 6.58  | 6     | 4.35  |
|                                                | Men                    | 10    | 16.1  | 12    | 15.8  | 22    | 15.9  |
| Changing crop type and crop variety            | Women                  | 10    | 16.1  | 12    | 15.8  | 22    | 15.9  |
|                                                | Men                    | 13    | 21.1  | 20    | 26.3  | 33    | 23.9  |
| Changing crop type, crop variety, and planting date | Women                  | 13    | 21.1  | 20    | 26.3  | 33    | 23.9  |
|                                                | Men                    | 38    | 61.3  | 39    | 51.3  | 77    | 55.8  |
| Crop type, crop variety, planting date, and using irrigation | Women                  | 38    | 61.3  | 39    | 51.3  | 77    | 55.8  |
|                                                | Men                    |        |       |        |       |       |
| Total                                          | Women                  | 62    | 100   | 76    | 100   | 138   | 100   |
|                                                | Men                    | 76    | 100   | 76    | 100   | 152   | 100   |
|                                                | Total                  | 138   | 100   | 152   | 100   | 290   | 100   |

Pearson chi-square (3) = 2.9565 Pr = 0.398
A number of other prior studies also report similar findings (Burke, 2019; Mulugeta & Tajani, 2021; Olalekan, Oyinlola et al., ; Sithole et al., 2021; Xiao & McCright, 2015).

Parallel with their major role of reproductive activities, women also actively participate in productive activities as men do. Productive activities are works that produce goods and services for consumption by household members or for income and is performed by both men and women. As reported by other authors (Dhenge et al., 2022; Xiao & McCright, 2015), our FGD result also confirms that women’s productive work is often carried out alongside their domestic and childcare responsibilities (reproductive work) and tends to be less visible and less valued than men’s productive work. Women are also active participants in community activities. Women’s community activities include provisioning and maintenance of resources, which are used by everyone, such as water, healthcare, and education (Akrofi et al., 2021; Dhenge et al., 2022; Olalekan, Oyinlola et al., ; Xiao & McCright, 2015). These activities are undertaken as an extension of their reproductive role and are normally unpaid and carried out in their free time.

4.4. Gender differences in climate change awareness

Global climate change is one of the greatest environmental challenges facing the world today than ever (Dhenge et al., 2022; OECD, 2021; Olalekan, Monsurat et al., 2019; Strapko et al., 2016). Studies also show that climate change alters the tasks people perform and their time use, affecting men and women differently (Mulugeta & Tajani, 2021; Olalekan, Oyinlola et al.). For example, the time needed for women’s work in gathering water and fuel will likely increase with water shortages and depletion of forests. This, in turn, will decrease the time available to women for food production and preparation as well as participation in income-generating activities will likely affect individual food security and nutritional well-being (Akrofi et al., 2021; Burke, 2019; Xiao & McCright, 2015).

Because climate change affects men’s and women’s livelihood differently (IPCC, 2019), women are more likely to be aware of environmental issues and climate changes than men do (Dhenge et al., 2022; Olalekan, Monsurat et al., 2019; Strapko et al., 2016; Vida, 2021). However, finding does not support this conclusion. Asked whether they know the major causes of climate change, all participants in the sample unequivocally stated that deforestation is the major cause in their areas. They also agreed that climate change is imminent and has been affecting their lives already. The respondents listed manifestations of climate change in the form of over flooding, frequent drought, increased temperature, reduced crop production and productivity, increased invasion of pest and insects, untimely rain, and health problems. This finding implies that climate change is becoming a hard fact and no more attitudinal issue.

4.5. Gender differences in vulnerability to climate change

Because women are often responsible for providing their households with the basic necessities of life such as food, fuel, and water, they rely heavily on natural resources. Thus, women are more likely to travel to forest because they mostly depend on natural resources than men do (IPCC, 2019). The following table 6 shows the difference in travel to forest between women and men.

As depicted in the table above, the difference between women and men in terms of frequency of travel is very visible and statistically significant. Women travel to forest more frequently than men do. While most women make travel to forest more frequently and on a regular base, men are found to travel to forest less frequently and on an irregular base. This may imply that women are more likely to be dependent on forest and hence vulnerable to climate change.

To further understand gender difference in vulnerability to climate change, the respondents were asked why they are travelling to the forest. The following table 7 shows sex disaggregated data on the response of the respondents.
As vividly depicted in the table above, women make frequent travel to forest mainly to collect fire woods, construction materials, fodder, and medicinal plants. These materials are related to basic necessities and part of the reproductive activities of women. On the other hand, men are making frequent travel to forest mainly to collect construction materials, for timber production, for hunting, and logging purpose. These are more or less related to the productive activities which are intended for commercial purpose. Men seldom have responsibility for collecting and using natural resources for household use. These findings are consistent with other studies (Burke, 2019; Duchelle et al., 2014; Perez et al., 2015; Sithole et al., 2021; Sundström & McCright, 2014; Xiao & McCright, 2015). Thus, environmental degradation and climate change increases women's time for labor-intensive household tasks, such as having to walk longer distances for the collection of fuel wood, and water. Decreases in agricultural production and household food security create additional health problems related to their increasing workload. Thus, climate change will affect men and women differently (Olalekan, et al., 2019).

4.6. Gender differences in climate change adaptation strategy choice

Studies show that gender differences exist in adaptation strategies (Akrofi et al., 2021; Djoudi & Brockhaus, 2011; Ingram et al., 2016; McCright & Xiao, 2014; Olalekan, Oyinlola et al., ; Perez et al., 2015; Sithole et al., 2021; Sweetman & Ezpeleta, 2017; Tibesigwa et al., 2015). Literature suggests that women may not see men's strategies as “coping”, while men may feel threatened by women's strategies. The following table 8 shows the gender difference in climate change adaptation strategy.

As depicted in the table above, there are a range of climate adaptation strategies used across Oromia zone both by women and men. These include changing planting date; changing crop variety; changing crop type, and investment in irrigation. Contrary to the documents of earlier literature (Burke, 2019; Gökmen, 2021; Olalekan, Monsurat et al., 2019; Olalekan, Oyinlola et al., ; Strapko et al., 2016), however, there is no statistically significant gender difference in climate change adaptation strategy in the study areas.

4.7. Determinants of participation in environmental conservations

To examine gender difference in environmental conservation, logit model specified in equation (6) above was fitted. In this case, the dependent variable was dummy, where “1” denoted if the individual participated in any of the afforestation/reforestation program in 2019 and “0” otherwise. Sex of the individual heads are included alongside with other independent variables.

Table 9 & 10 below shows the result of logit model. The table reports both the logistic regression coefficients together with their odds ratio at the last column. Because the magnitude of the logistic regression coefficients do not convey any social or economic significance, it is always preferable either to interpret the marginal effect estimates or the odds ratio estimates (Verbeek, 2017). In this article, odds ratio estimates are interpreted.

The response probability $P_i = Pr (Y_i = 1 \mid X_i)$ refers to the probability of an individual participating in afforestation/reforestation given his/her personal characteristics $i \times X$. If the odds ratio $Exp(B)$ is less than one, this means that the odds (or the likelihood) of an individual participating in the environmental conservation is higher for the reference category (Verbeek, 2017). On the other hand, if $Exp(B)$ is greater than one, then the odds are higher for a particular category as compared to the reference category. The odds ratio for sex (1) ($Exp(B) = 0.032$) is less than one. Since the coding sex (1) refers to men and the reference category sex (0) is women, the odds of a men participating in environmental conservation is smaller than that of a women. This implies that the women are more likely to be concerned in environmental conservation than the men. The inverse of $Exp(B)$ is $Exp(-B) = 1/0.032 = 31.25$. Thus, women are 31.25 times more likely to participate in environmental conservation than men after controlling for other socioeconomic and institutional factors. This finding is consistent with other literature (Burke, 2019; Duchelle et al., 2014; Ingram et al., 2016; Olalekan, Oyinlola et al., ;
Table 9. Determinants of participation in environmental conservation

| Determinant variables | Coeff. | Std. Err. | z   | P>|z|   | [95% Conf. Interval] |
|-----------------------|--------|-----------|-----|-------|----------------------|
| Log likelihood        | -25.57574 |          |     |       |                      |
| LR chi-square (10)    |         | 51.58     |     |       |                      |
| Prob > chi-square     |         | 0.0000     |     |       |                      |
| Pseudo R²             |         | 0.4982     |     |       |                      |
| Number of obs         | 140     |           |     |       |                      |
| Sex of individual     | -3.433 | 1.703     | -2.02** | 0.044 | -6.769, -0.096       |
| No. of full time      | 1.975  | 0.962     | 2.05** | 0.040 | 0.089, 3.861         |
| farmers               |         |           |     |       |                      |
| Married (1 = yes)     | -0.360 | 1.055     | -0.340 | 0.733 | -2.429, 1.708        |
| Religion (1 = Muslim) | 3.331  | 1.094     | 3.04*** | 0.002 | 1.187, 5.475         |
| Livestock (TLU)       | -0.469 | 0.178     | -2.64*** | 0.008 | -0.817, -0.121       |
| Institutional trust   | 6.494  | 1.872     | 3.47*** | 0.001 | 2.825, 10.164        |
| (1 = yes)             |         |           |     |       |                      |
| Work load             | -1.440 | 0.676     | -2.13** | 0.033 | -2.766, -0.114       |
| (hour/day)            |         |           |     |       |                      |
| Env’tal view          | 2.627  | 1.235     | 2.13** | 0.034 | 0.205, 5.048         |
| (1 = yes)             |         |           |     |       |                      |
| ,cons                 | 6.617  | 6.043     | 1.100 | 0.273 | -5.227, 18.461       |

Note: ***, **, * significant at 1%, 5% and 10%, respectively

Perez et al., 2015; Sithole et al., 2021; Sundström & McCright, 2014; UN, 2021a; Villamor et al., 2014; Xiao & McCright, 2015. But why are women more likely to be concerned about environment than men do? Is it really because of their difference in institutional trust as hypothesized by the literature (Xiao & McCright, 2015)? The following table shows institutional trust difference between women and men.

The result shows that there is no statistically significant difference between women and men in terms of institutional trust. It seems that significant proportions of both women and men do trust laws governing natural resources conservation and utilizations. Thus, institutional trust difference does not explain any gender difference in environmental concern. Thus, gender difference in environmental concern is influenced by gender socialization (Ferdous & Mallick, 2019; Goodrich et al., 2019; Khandekar et al., 2019; McCright & Xiao, 2014; Sundström & McCright, 2014; Sweetman & Ezpeleta, 2017; Xiao & McCright, 2015). Gender socialization is the process through which men and women are encouraged to adopt and develop certain values and orientations that are commonly called masculinity and femininity. According to this theory, women are socialized to value the needs of others and develop an ethic of care that leads them to behave in more selfless ways (Xiao & McCright, 2015). They then extend these value orientations to the environment in order to explain why women are more environmentally concerned than men. They value and practice significant amounts of unpaid care and emotional work, even if their spouse remains at home, while continuing their major role of reproductive activities explained above. Because men are socialized as bread winners and marketplace mentality in their families, they are less likely to participate in non-paid activities (Xiao & McCright, 2015; Olalekan, et al., 2019).
Table 10. Gender difference in institutional trust

|                      | Women |       | Men |       | Total |       | χ² value |
|----------------------|-------|-------|-----|-------|-------|-------|----------|
|                      | N %   | N %   | N % |       |       |       |          |
| Do you trust laws governing utilization of natural resources? | | | | | | | |
| No                   | 8 12.9| 6 7.69| 14 10|       |       |       | 0.307    |
| Yes                  | 54 87.1| 72 92.31| 126 90|       |       |       |          |
| Total                | 62 100| 78 100| 140 100|       |       |       |          |

The result also shows that households with more family members engaged in agriculture as full-time employment are more likely to participate in environmental conservation. Increase in one more family members’ engagement in agriculture is expected to increase participation in environmental conservation by 7.205 times. The plausible justification could be as more members of the households are engaged in agriculture, the more the livelihood of that family is directly related to natural resources and hence more likely to be concerned about environment. This line of argument is also supported by other literature (Xiao & McCright, 2015).

The other interesting finding is the role of religion in environmental concern. Muslims are 27.961 times more likely to participate in environmental conservation than other religion followers. This could be because Muslim’s doctrine is less likely to prohibit works on week-ends and have less number of holidays each month than other religions such as Orthodox Christianity in the study areas.

The other interesting finding is the role of livestock possession in environmental conservation. The result shows that individuals with one livestock possession in terms of TLU are less likely to participate in environmental conservation by 0.626 times. This could be partly because such individuals are more likely to rely on their livestock for their livelihoods and partly because more afforestation/reforestation means they will have less grazing lands for their large livestock populations.

Although we could not find any statistically significant difference in institutional trust between women and men, the result shows that those families who trust institutions are 661.343 times more likely to participate in environmental conservation. This could be because having institutional trust implies obeying the rules and regulations and hence more likely to participate. They also feel sense of ownership for the program and hence will be more committed to afforestation/reforestation program. This is also consistent with other literature (Duchelle et al., 2014; Sundström & McCright, 2014; Xiao & McCright, 2015).

As expected, work load is negatively influencing participation in environmental conservation. Increase in the daily work load by 1 hour is more likely to reduce someone’s participation in environmental conservation 0.237 times. This finding is also consistent with other literature (Sundström & McCright, 2014; Xiao & McCright, 2015). The policy implication of this finding is that government needs to consider supply of labor saving technologies such as improved cook stoves, biogas, off-grid electricity supply, and irrigation techniques to reduce the individual’s work burdens.

As expected, those individuals who view their environment as important factor in their livelihood and hence willing to sacrifice some economic benefits for the sake of environment are 13.83 times more likely to participate in environmental conservation. Thus, having the right mental attitude about environment is found to be one of the determinants for participation in environmental protection. This finding is also consistent with other literature (Dhenge et al., 2022; Gökmen, 2021; UN, 2021a).
5. Conclusion and policy implications

5.1. Conclusions
As opposed to the men, women have triple roles: as food producer, as resource managers, and as caretakers of their families. These triple roles often present the conflict of trading stewardship of the resource base in favor of meeting household consumption needs. In the study areas, firewood remains a major source of energy for cooking. As a result, women spend substantial amounts of time gathering and transporting fuel wood from the community forests or private lands and also illegally from the national forests. Collection activities compete for time spent in food preparation, child care, and providing for the household nutrition. These competing obligations may affect the expendable time women need for undertaking more environmentally sound practices, in concert with their long-term role as guardians of their resources and their specialized knowledge about their use and management. Women are more likely to be dependent on natural resources and hence more vulnerable to climate changes then men. However, there is no gender-based difference in terms of causes and consequences of climate change awareness. Climate change has now become the universal facts, and hence both women and men are equally aware of it. Both women and men also equally practice in a number of climate change adaptation strategies (changing crop type, changing crop variety, changing planting dates, and use of irrigation as alternative). There is no gender-based difference in institutional trusts. Both women and men have a good deal of trust in social institutions and less trust in government institutions. However, women are more likely to participate in environmental conservations because they have modestly stronger pro-environmental values, beliefs, and attitudes than do men.

5.2. Policy implications
Based on the main findings and conclusions drawn from the study, the following policy implications can be drawn.

- The regional water, mineral, and energy bureau needs to invest in interventions that reduce workloads for women and reduce fuel wood consumption. To this end, there is a need to increase the incentive and distribution of improved cooking stoves (ICS) and biogas. There is a need to develop and conduct outreach program to increase number of women—particularly those of marginalized groups—accessing incentives and using biogas/ICS. Thus, there is a need to increase subsidies provided for upfront installation costs for marginalized women. There is also a need to provide training for women to become to be able to construct and service biogas plants and ICS.

- The regional bureau of agriculture need to encourage the smallholder farmers to shift from keeping large number of local cows to maintaining few hybrid cows so as to increase their productivity while decreasing their impact on environment.

- Finally, the regional government is advised to:
  - Organize gender-awareness seminars and workshops for forestry officials, including decision-makers and policy committee members, to ensure a deeper understanding of the relevance of the concerns of women in forest policies and programmes.
  - Initiate dialogue and organize consultation meetings at national and sub-national levels to discuss relevant gender issues and gaps in existing forest policies and practices.
  - Engage civil society organizations, government institutions and relevant women’s networks to ensure inclusive approaches to the development and implementation of gender-responsive forest policies.
  - Strengthen the capacities of existing gender focal points within institutions to engage at a substantive level in forestry-related consultations and in policy review and development processes.

6. Scope and limitations of the paper
In terms of geographic coverage, this study is limited to only two zones of about 20 zones in the Oromia regional state. As explained in the methodology section, we have chosen one zone from the seven zones classified as hotspot areas and one zone from 13 zones classified as non-hotspot zones in terms of forest degradation status. Similarly, we have chosen equal number of districts from hotspot
and non-hotspot districts, regardless of the number of districts classified under each. Thus, because the selection of study zones and districts within each zone were not made based on probability proportion to their size in terms of their classification as hotspot and non-hotspot areas, individuals in the hotspot and non-hotspot zones might have not been equally represented in the sample. We understand that this might have introduced selection bias. However, in our statistical data analysis, we have applied sampling weights to remedy for the potential bias that might have been introduced during multistage sampling. Although a systematic search process is used to identify relevant literatures on gender difference in environmental concern, this cannot be treated as an exhaustive process.

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**Notes**
1. Woreda and Districts are interchangeably used in this paper.
2. Kebele is the smallest government administrative structure in Ethiopia.

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**References**
Abbasii, S. S., Anwar, M. Z., Habib, N., Khan, O., & Waqar, K. (2019). Identifying gender vulnerabilities in context of climate change in Indus basin. Environmental Development, 31(November 2018), 34–42. https://doi.org/10.1016/j.envdev.2018.12.005
Akrofi, M. M., Mahoma, M., & Nevo, E. M. (2021). Nexus between the gendered socio-economic impacts of COVID-19 and climate change: Implications for pandemic recovery. SN Social Sciences, 1(8), 1–20. https://doi.org/10.1007/s43545-021-00207-5
Ampaire, E. L., Acosta, M., Huyer, S., Kigonya, R., Muchunguzi, P., Muna, R., & Jassogne, L. (2020). Gender in climate change, agriculture, and natural resource policies: Insights from East Africa. Climatic Change, 158(1), 43–60. https://doi.org/10.1007/s10584-019-02447-0
Burke, S. (2019). Differentiated impacts of climate change on women and men; the integration of gender considerations in climate policies, plans and actions; and progress in enhancing gender balance in national climate delegations: Synthesis report by the secretariat. Gender and Climate Change, FCCC/SBI/21(June), 17–27. https://unfccc.int/sites/default/files/resource/sbi2019_inf8.pdf
Dhenge, S. A., Ghodse, S. N., Ahire, M. C., Gorantwar, S. D., & Shinde, M. G. (2022). Gender attitude towards environmental protection: A comparative survey during COVID-19 lockdown situation. In Centre for Advanced Agriculture Science and Technology for Climate Smart Agriculture and Water Management (Ed.), Environment, development and sustainability (Issue 0123456789). Springer Netherlands. https://doi.org/10.1007/s10668-021-02015-6
Djoudi, H., & Brockhaus, M. (2011). Is adaptation to climate change gender neutral? Lessons from communities dependent on livestock and forests in the northern Mali. International Forestry Review, 13(2), 123–135. https://doi.org/10.1505/146554811797406606
Duchelle, A. E., Almeyda Zambrano, A. M., Wunder, S., Börner, J., & Kainer, K. A. (2014). Smallholder specialization strategies along the forest transition curve in Southwestern Amazonia. World Development, 64(s1), S149–S158. https://doi.org/10.1016/j.worlddev.2014.03.001
Ferdous, J., & Mallick, D. (2019). Norms, practices, and gendered vulnerabilities in the lower Teesta basin, Bangladesh. Environmental Development, 31 (June 2018), 88–96. https://doi.org/10.1016/j.envdev.2018.10.003
Gökmen, A. (2021). The effect of gender on environmental attitude: A meta-analysis study. Journal of Pedagogical Research, 5(1), 243–257. https://doi.org/10.3390/jprt.202116799
Goodrich, C. G., Prakash, A., & Udas, P. B. (2019). Gendered vulnerability and adaptation in Hindu-Kush Himalayas: Research insights. Environmental Development, 31 (November 2018), 1–8. https://doi.org/10.1016/j.envdev.2019.01.001
Huluka, A. T., Wondimogechnu, B. A., & Yildiz, F. (2019).Determinants of household dietary diversity in the Yoyo biosphere reserve of Ethiopia: An empirical analysis using sustainable livelihood framework. Cogent Food & Agriculture, 5(1), 1690829. https://doi.org/10.1080/23311932.2019.1690829
Ingram, V., Haverhals, M., Petersen, S., Elias, M., Basnett, B. S., & Ph ossio, S. (2016). Gender and forest, tree and agroforestry value chains: Evidence from literature. In Pierce Colfer, C. J. et al. (eds.), Gender and Forests: Climate Change, Tenure, Value Chains and Emerging Issues, 221–242. New York: Routledge. https://doi.org/10.4324/9781315666624
IPCC. (2019). Differentiated impacts of climate change on women and men; the integration of gender considerations in climate policies, plans and actions; and progress in enhancing gender balance in national climate delegations. UN.
Khander, N., Garti, G., Bhadwal, S., & Rijhwani, V. (2019). Perceptions of climate shocks and gender vulnerabilities in the Upper Ganga Basin. Environmental Development, 31(February), 97–109. https://doi.org/10.1016/j.envdev.2019.02.001
Kothari, C. (2004). Research methodology (2nd ed.). New Age International (P) Ltd.
Mazzucato, D., Benelli, P., & Walker, P. (2013). How sexual reproduction, gender and generational analyses can improve humanitarian response. Disasters, 37(SUPPL.1). https://doi.org/10.1111/di.12013
McCrith, A. M., & Xiao, C. (2014). Gender and environmental concern: Insights from recent work and for future research. Society & Natural Resources, 27(18), 1109–1113. https://doi.org/10.1080/08941920.2014.918235
Mulugeta, G., & Tofani, F. (2021). The role and determinants of women labor force participation for household poverty reduction in Debre Birhan town, North Shewa zone, Ethiopia. Cogent Economics and Finance, 9(1), 1-18. https://doi.org/10.1080/23322039.2021.1892927

OECD. (2021). Gender and the environment. Gender and the Environment, 1–319. https://doi.org/10.1787/3d32ca39-en.

Olalekan, R. M., Monsurat, S. R., Emmanuel, O. O., & Toluolope, S. J. (2019). Women role in environmental conservation and development in Nigeria. Ecology & Conservation Science, 1(2), 1–16. https://doi.org/10.19080/ECSOA.2019.01.555558.

Perez, C., Jones, E. M., Kristjanson, P., Cramer, L., Thornton, P. K., Förch, W., & Barahona, C. (2015). How resilient are farming households and communities to a changing climate in Africa? A gender-based perspective. Global Environmental Change, 34(1), 95–107. https://doi.org/10.1016/j.gloenvcha.2015.06.003

Sithole, M., Phiri, K., Masabo, T., & Serpa, S. (2021). Gendered spaces in natural resource utilisation for sustainable development in rural communities of Zimbabwe. Cogent Social Sciences, 7(1), 1909792. https://doi.org/10.1080/23311886.2021.1909792

Strapko, N., Hempel, L., Macilroy, K., Smith, K., Strapko, N., Hempel, L., Macilroy, K., & Gender, K. S. (2016). Gender differences in environmental concern: Reevaluating gender society & natural resources gender differences in environmental concern: Reevaluating gender socialization. Society and Natural Resources, 29 (9), 1015–1031. June 2018. https://doi.org/10.1080/08941920.2016.1138563

Sunstraöm, A., & McCright, A. M. (2014). Gender differences in environmental concern among Swedish citizens and politicians. Environmental Politics, 23(6), 1082–1095. https://doi.org/10.1080/09640406.2014.921462

Supriya Akerkar, A. (2022). Gender and Older People. February. United Nation Departmentof Economic and Social Affairs (UN DESA), New York. https://www.un.org/development/desa ageing/wp-content/uploads/sites/24/2022/03/Gender-and-Older-People-Supriya-AKERKAR.pdf

Sweetman, C., & Espeleta, M. (2017). Introduction: Natural resource justice. Gender and Development, 25(3), 353–366. https://doi.org/10.1080/13552074.2017.1395138

Tessio, G. (2014). The gender dimension of vulnerability to climatic shocks in low income country. Asian Journal of Agricultural Extension, Economics & Sociology, 3(6), 690–704. https://doi.org/10.9734/AAEES/2014/9716

Tibesigwa, B., Visser, M., Hunter, L., Collinson, M., & Twine, W. (2015). Environment for development gender differences in climate change risk, food security and adaptation: A study of rural households’ reliance on agriculture and natural resources to sustain livelihood. Environment for Development, 15(August), 1–37. https://www.jstor.org/stable/2103284
