# Factors Affecting People's Environmental Awareness In The Urban Areas: A Case of Addis Ababa, Ethiopia

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**ABSTRACT**

***Background:*** *In developing countries, the urban environment is deteriorating over time. In the meantime, people's demand for clean and green residential and recreational places has increased. If so, why has it been hard to keep clean and green cities? This paper investigates the level and determinants of environmental awareness in Addis Ababa. From three sub-cities, a three-stage sampling procedure applies to select 293 sample respondents. The data collection applies a structured questionnaire. We applied a five-point Likert scale to classify the levels of awareness. Besides, an ordered logit model was applied to analyze factors that affect the level of awareness.*

***Results:*** *The result shows that the knowledge of forest degradation is high, while the attitude to reduce the use of glass bottles is medium. The cognitive skill on the cause of acid rain is medium. The probability of low (13%) and medium (26%) levels of environmental awareness increases for the income group of 601 to 1650. Likewise, the likelihood of having low levels of environmental awareness rises by 9%; in contrast, the probability of having a moderate level of environmental awareness increases by 12% for the age of 50 to 59. The TVET educational level has a low chance of having low (8%) and medium (12%) levels of awareness.*

***Conclusions:*** *An income-generating activity raises employment opportunities and creates a better income, which would influence the environmental mindset. So,* i*mproving the living standard assures clean and green cities. Besides, the higher the education, the better would be environmental knowledge, cognitive skills, and attitude. In the meantime, besides formal education, adult education, training, and workshops are alternatives to enhance environmental awareness.*

**Keywords**: Addis Ababa; environmental awareness; Likert scale; urban environment; ordered logit

Subject classification codes: C10; Q53; Q57; Z13

# 1 INTRODUCTION

Environmental quality links to the use of resources and waste disposal. It relates to the effluent systems and waste management (Hoornweget al., 2011), greenhouse gas and particulate matter (Shanmugam and Hertelendy, 2011), and poor infrastructure, and meager urban planning (Colombani et al., 2018; Liu et al., 2015). In developing countries, lack of standard inbuilt sewerage systems, poor waste management (Gondo et al., 2010), and volatile gases (Kaushal and Sharma, 2016; Kumar et al., 2016) provoke environmental pollution. Environmental pollution links people's environmental awareness (ECLAC, 2004; Momoh and Oladebeye, 2010) and their consumption behavior (Xu et al., 2019). Hence, working on people’s awareness gives strength to manage the environment (Giudici et al., 2019). Awareness also links to education (Mutisya and Barker, 2011), residential places (Bickersta and Walker, 2001), and technological knowledge (Giudici et al., 2019).

Rivers and groundwater deterioration (Ademe and Molla, 2014; Eriksson and Sigvant, 2019) and air pollution (UN Environment, 2018) are Ethiopia's causes of environmental degradation. Over the last 30 years, the urban environment impaired following population expansion, industrialization, and urbanization (Akalu et al., 2011; Eriksson and Sigvant, 2019; Worku and Giweta, 2018). The Ethiopian Environmental Protection Authority (1997) emphasized improving, sustaining, and keeping the environment. Besides, the Climate Resilient Green Economic strategy gives due attention to green cities, landfill gas, and wastes (FDRE, 2011). The transport policy also emphasizes wastes associated with the transport system (Ministry of Transport, 2011).

Even though materials on environmental awareness (MoFED, 2006) have been producing, the environment in Ethiopia faces multi-dimensional problems (Danyo et al.,

2017). Therefore, examining factors affecting people's environmental awareness is incontestable. Despite the importance of the topic, empirical studies hardly examined environmental awareness in Addis Ababa. Existing studies focused on the human impact, urban rivers, watershed land use, surface water pollution, and flood vulnerability (Akalu et al., 2011; Asnake et al., 2021; Eriksson and Sigvant, 2019; Mohamed and Worku, 2020). Several studies conducted on solid waste (Beyene and Banerjee, 2011; Destaw et al., 2013; T. Getahun et al., 2012; Regassa et al., 2011), river and groundwater contamination (Awoke et al., 2016; Gebre and Rooijen, 2009; Gondo et al., 2010; Goshu et al., 2010; Mazhindu et al., 2010), and air pollution (Do et al., 2013). While, few studies examining the environmental awareness in the farming communities (Adem, 2017) and among students (Emiru and Waktola, 2018). The paper's organization follows the introduction, material, and method section, explain the analytical framework, study area, data collection tool, model specification, and variable characteristics. The result section explains the demographic characteristics, level of environmental awareness, and factors affecting awareness. The discussion section elaborates the key findings concerning the existing knowledge. Last, the conclusion section summarizes the main findings and forward recommendations.

## 2 MATERIALS AND METHODS

### 2.1 Conceptual frameworks

Figure 1 shows the study procedure from questionnaire development up to defining components of environmental awareness, from the list of pre-defined environmental items, identifying and screening out the reliability by Cronbach's alpha. The framework depicts environmental awareness as the components of knowledge, cognitive skill, and attitude.

Environmental awareness helps to assess people's consciousness in their activity (Partanen-Hertell et al., 1999). Awareness is being conscious of something. According to Rohrer (2002), it is the sum of all abilities which permit humans to respect fundamental rights. Hence, a high level of awareness correlates with the conscious choice of environmentally friendly practices (Partanen-Hertell et al., 1999).

The components of awareness such as knowledge, attitude, and cognitive skills are described differently by different scholars. Morreale et al. (2007) divide knowledge into content knowledge and procedural knowledge. Content knowledge is a literal understanding of the subject, words, or meanings. Procedural knowledge emphasizes practicing the content knowledge. So, knowledge is a process that developed and constantly grew (Watson and West, 2006). However, Williams (2002) expressed it as a combination of belief and fact.

Attitude is the association between an object and the evaluation of that object (Fazio, 1990). Motivation is the determining component of behavior and attitude (Fazio, 1990). At the same time, attitude and behavior have some relationship (Borba, 2004; Fazio, 1990). The perception of potential reward value determines motivation (Morreale et al., 2007). Similarly, individuals can build motivation (Partanen-Hertell et al., 1999), yet attitude enables them to decide (Crano and Prislin, 2008; Sanbonmatsu and Fazio, 1990). So, there is a correlation between attitude and behavior (Cialdini et al., 1981), yet they are too different. Hence, Borba (2004) put this distinction as:

> *Behaviors are on the surface; attitudes run deep. Behaviors are actions; attitudes are a way of looking at life. Anyone can see the behaviors; attitudes are often hidden and hard to figure. Behaviors are more reactive and impulsive; attitudes take long term. Behaviors are a child's way of coping with the world; attitudes are the foundation of her character. Behaviors are here and now; attitudes will determine her destiny.*

Skills are also associated with the habit of using something (Partanen-Hertell et al., 1999). A person may have the motivation to act, due to lack of acting skill low performance might happen (Morreale et al., 2007). Thus, skills express the competency, ability, aptitude, capacity, and habit of doing something. Stopford (2009) expresses the distinction between skill and knowledge as the border between academic and professional. While Ingold (2000) looks at skills and knowledge together, the skill is the effective use of knowledge.

### 2.2 The Study Area

Figure 2 depicts the geographic map of Addis Ababa, the federal capital city of Ethiopia. Addis Ababa was founded and got its name in 1886 by Emperor Menelik II and his wife, Empress Taitu (UN-Habitat, 2017). The city has an altitude between 2300 meters in the south and 3000 meters in the north. According to Central Statistical Agency (CSA) (2013), the total population size and density were 3,434,000 and 6,516.25/ km2, respectively. Among the total population, 47.3% were male and 52.7% female. The annual fertility rate was 2.1 (CSA, 2013). The organization of the city is by ten sub-cities and 118 districts (Abebe et al., 2018).

### 2.3 Data Collection and Questionnaire Design

Enumerators did data collection using a structured questionnaire from respondents in three sub-cities. Non-probability and probability sampling methods were adopted to collect primary data. We follow a three-stage sampling procedure to sample size selection. In the first stage, the researchers categorize ten sub-cities into three strata based on their population density. The official document shows that six sub-cities, such as Bole, Yeka, Gulele, Kolfe-Keraniyo, Nifas Silk, and Akaki-Kalit, had a population density lower than or equal to ten thousand.

In contrast, the Addis-Ketema sub-city alone has over twenty-five thousand. The remaining sub-cities, such as Arada, Lideta, and Kirkos, are between the two groups. So, one sub-city was randomly selected from each stratum as a sample frame. In the second stage, three districts were selected from the three sub-cities by simple random sampling. Thus, 293 household members were designated as a proportional sample using the statistical formula developed by Yamane (1967), as Israel (1992) cited. The proportional samples are districts 3 from Addis Ketema sub-city; sample size equal to 88, districts 6 from Bole sub-city; sample size equal to 100, and districts 8 from Arada sub-city; sample size equal to 105. So, from the list of household heads (HH), one respondent was selected using the lottery method from the list of the first ten HH. Then, we used an interval technique to select respondents until the proportional sample meets.

A questionnaire was developed to investigate peoples' environmental awareness. The tool contains questions on socio-economic, demographic, and environmental questions. Question on environmental knowledge addresses pollution, its cause, source, and the effect of solid, liquid, and gaseous wastes. The cognitive skills questions focused on the effect of consuming goods and services on the environment, for instance, using different types of energy sources, tree planting and cuttings, agricultural practice, livestock rearing, and solid and liquid waste disposals. Questions on environmental attitude also address practical actions by the respondents to reuse, recycling, reducing, and recovering of goods and services. Therefore, they responded on a five scale, '1= very low to 5 = very high'. Thus the questionnaire was translated from English to the Amharic language, and enumerators are recruited and trained. Then, data were collected on a face-to-face basis for three weeks, starting from the end of May 2019 to mid-June 2019.

### 2.4 Model Specification and data analysis

Descriptive and inferential statistics are used to analyze the data. Five Likert scales are prepared to see the level of environmental awareness through the environmental items under the three components: environmental knowledge, cognitive skills, and attitude. Environmental things are expressed in negative and positive statements to avoid bias. The response scale for each environmental item is1 to 5.Thus, the response to the negative report has a reverse value. The sum of the scale is represented the full scale. The maximum total scale is 5*n, and the lowest possible scale is 1*n. Where 'n' is the total number of environmental items listed under the three components, each respondent's level of environmental awareness is computed by Eq. 1.

$$EA_r = \frac{\sum_{i=1}^{n} LS}{n} \quad (1)$$

Where EAr represents the level of environmental awareness for the respondent (r), i represents the environmental questions listed in the three components (i = 1… n), LS represents the response scale for each environmental question (1… 5). The value of EAr categorized as "1= very low if the value of EAr < 1.5", "2= low if 1.5 ≤ EAr < 2.5", "3= medium if 2.5 ≤ EAr < 3.5", "4= high if 3.5 ≤ EAr < 4.5", "5= very high if EAr ≥ 4.5=".

An econometric model is also used to examine factors affecting people's environmental awareness. Here, environmental awareness is a categorical dependent variable ordered as very high, high, medium, low, and very low. Although an unordered multinomial model can estimate such data, a much more economical and sensible model considers this ordering. Thus, the choice of the ordinal probit model fits more critically than the multinomial model to address the level of environmental awareness (Gujarati, 2004). Therefore, the starting point is an index model with a single latent variable, y* (Eq. 2).

$$y_i * = \sum_{k=1}^{k} X_{ki}\beta_k + \varepsilon_i = z_i + \varepsilon_i \quad (2)$$

$$Z_i = \sum_{k=1}^{k} X_{ki}\beta_k = E(Y_i) \quad (3)$$

Y is collapsing a version of y*, e.g., y* can take an infinite range of values which might be five orders of Y. As y* crosses a series of increasing unknown thresholds (Cut, αi), we move up the ordering of alternatives. For example, for y*< α1, awareness is very low, for y* > α1, awareness improved to the highest level. So, the observed variable 'Y' value depends on whether it crossed a particular threshold. Since there are five potential values for Y (Cameron and Trivedi, 2005; Greene, 2003), the respondent awareness probability is in one of the fifth levels (Eq. 4).

$$P(y_i *= m) = \frac{exp^{(X_i\beta-\alpha_{m-1})}}{1+[exp^{(X_i\beta-\alpha_{m-1})}]} \quad (4)$$

Where m is the level of awareness, α is a particular threshold (4 cuts) in which the value of the observed variable Y, Xi is an explanatory variable that affects the level of awareness, and β is the unknown estimated parameter. Therefore, factors affecting people's environmental awareness are analyzed by the Ordinal probit model expressed as Eq. 5 using STATA software version 15.

$$EA = \beta_0 + \sum_{i=1}^{n} \beta_i X_i + \varepsilon_i \quad (5)$$

$$Z_i * = \sum_{k=1}^{k} \beta_k X_{ki} = E(y_i *) \quad (6)$$

Where y* is the unmeasured latent variable whose values figure the observed ordinal environmental awareness, EA, Xi is an explanatory variable such as income group (I), family member (F), educational level (E), age (A), and sex (S). So, the probability of environmental awareness being in one of the five levels is computed as in Eq. 7-11.

$$P(EA = 1) = \frac{1}{1 + exp^{(Z_i - \alpha_1)}} \quad (7)$$

$$P(EA = 2) = \frac{1}{1 + exp^{(Z_i - \alpha_2)}} - \frac{1}{1 + exp^{(z_i - \alpha_1)}} \quad (8)$$

$$P(EA = 3) = \frac{1}{1 + exp^{(Z_i - \alpha_3)}} - \frac{1}{1 + exp^{(z_i - \alpha_2)}} \quad (9)$$

$$P(EA = 4) = \frac{1}{1 + exp^{(Z_i - \alpha_4)}} - \frac{1}{1 + exp^{(z_i - \alpha_3)}} \quad (10)$$

$$P(EA = 5) = 1 - \frac{1}{1 + exp^{(Z_i - \alpha_4)}} \quad (11)$$

Where,

EA= 1 if y*i ≤ α 1; very low level of environmental awareness

EA = 2 if α 1≤ y*i ≤ α 2; low level of environmental awareness

EA = 3 if α 2 ≤ y*i ≤ α 3; medium level of environmental awareness

EA = 4 if α 3 ≤ y*i ≤ α 4; high level of environmental awareness

EA = 5 if y*i ≥ α 4; very high level of environmental awareness

### 2.5 Variables Characteristic

Explanatory variables were identified and defined to assess the socio-economic and demographic factors that affect environmental awareness. EA is an ordered categorical dependent variable measures the level of awareness. Individuals may have a very low, low, medium, high, and very high level of environmental awareness depends on socio-economic factors such as income, family member, education, age, and gender. Income is a continuous, categorical variable, grouped based on the personal income tax of Ethiopian tax revenue authority, which shows the family's total income in Ethiopian currency, Birr (ETB) (1USD = 38.02 ETB), per month. The family member is a continuous, categorical variable that shows the number of persons who lived together with the respondent. The family member is categorized into 1 to 5 family sizes, 6 to 10 family sizes, and over ten family sizes. Education level is the other continuous, categorical variable which is measured by the completed education groups such as primary, secondary, Technical Vocational Educational and Training (TVET), and

Higher education (First degree and above). The respondent's age is a continuous, categorical variable that is arranged into six groups (17-29, 30-39, 40-49, 50-59, 60-69, and 70-100). Gender is the biological classification of the respondent's sex. It is a dummy variable that is assigned 1 if the respondent is male, otherwise 0 for female respondents.

## 3 RESULTS

This section describes the environmental awareness components, socio-demographic characteristics, and order logit model results. The first three subsections explain statistical results regarding the respondents' environmental knowledge, cognitive skill, and attitude. Then, respondents' demographic and economic characteristics. The final sub-section is about ordered logit results.

### 3.1 Environmental Knowledge, cognitive skills, and attitude

Five Likert scales were applied to assess people's environmental awareness. It encompasses three components; environmental knowledge, environmental, cognitive skill, and environmental attitude. The first step is to check the reliability of questions using Cronbach's alpha test. Among the first 87 environmental questions, 46 questions pass the reliability test. Results show that Cronbach's $\alpha > 0.7$ and the item test correlation are over 0.3.

Respondents rate their answers to environmental knowledge questions on a five-point scale. The questions focused on the concepts, causes, sources, and effects of pollution, degradation, and conservation. The questions scoring a highly reliable index. On average, the respondents have medium to high conceptual knowledge, high knowledge of the causes and effects, and medium knowledge of the source of pollution (Table 1). They also have higher knowledge of forest degradation as compared with

surface and air pollution. In contrast, their knowledge of air pollution is the least of other types of environmental knowledge.

The questions on cognitive skills focus on energy sources, deforestation, planting trees, and Green House Gases. The mean of these measures ranges from medium to high, which has a high-reliability index. On average, the respondents have high cognitive skills on the negative contribution of waste disposal and deforestation. In contrast, they have medium cognitive skills on the cause of acid rain (Table 2).

Attitude questions focus on reducing glass bottles, plastic bottles, cans, and fossil fuels. As a result, the mean value ranges from medium to high attitudes with a high-reliability index. On average, the respondents show a high attitude towards reducing the consumption of cylinder gas, while they have a medium attitude towards reducing the use of glass bottles (Table 3).

### 3.2 Respondents' Characteristics and Environmental Awareness

The descriptive result in Table 4 shows the variation in the level of environmental awareness. There are variations among the income groups, family size, educational level, age groups, gender, and districts. The Chi-square value shows awareness varies significantly among income groups, education, age, and the gender of respondents. Nevertheless, the levels of environmental awareness do not show substantial variation within the family member and among districts.

The level of environmental awareness differs across income groups at $p < 0.01$. In all income groups' high level of environmental awareness is the dominant, except the income group 601-1650. It is high and very high for 91% of respondents in the highest income group, while the remaining 8.7% have a medium level of awareness. Environmental awareness varies among educational groups at $p < 0.001$. Most TVET

(55.6%) and higher education (29.6) score a high and very high level of awareness, respectively.

In contrast, the secondary academic level has a medium level of awareness (33%) compared to others. The primary education level has very low (1.9%) and low (14%) environmental awareness. It suggests that as the completed educational level increases, the level of environmental awareness shows improves.

The levels of environmental awareness also vary within the respondents' age group at $p < 0.1$. The level of awareness is highest with the age group of 40-49, while it is the lowest for 17-29, 50-59, and 70-100 years old. Gender variation also shows a difference in the level of environmental awareness. Most male (50%) and female (43%) respondents have a high level of environmental awareness, while 24.7% of males and 35% of females have medium awareness. The number of male respondents with a high and very high level of environmental awareness is more than female respondents.

### 3.3 Factors that affect Environmental Awareness

Table 5 shows the model fitness by Chi-square result, at $P<0.0001$ level of significance. It means the model has at least one explanatory variable which affects environmental awareness. The post estimation values such as heteroscedasticity, omitted variables, and multicollinearity reveal that the results are free from bias. Income level, education level, and age group affect the level of environmental awareness.

The income groups from 601 up to 5250 significantly affect environmental awareness at $P<0.01$. Those respondents with TVET and first degree and education levels positively affect it at $P < 0.01$ and $P < 0.05$, respectively. Similarly, being above 49 years old has lower environmental awareness than being below 30 years old. Likewise, age between 60 to 69 and 70 to 100 years old negatively affects their environmental awareness level at the $P<0.05$ level of significance.

Table 6 describes the marginal effect of the predicted value keeping other variables constant. For the income group of 601 to 1650, the probability of the low level of environmental awareness and a medium level of environmental awareness increase by 13% and 26%, respectively. In contrast, the probability of respondents at a very high level of environmental awareness decreases by 32%. Similarly, the probability of low and medium levels of environmental awareness increase by 10% and 23%, respectively, for the income group 1651 to 3200. While the probability of a very high level of environmental awareness decrease by 30%. Likewise, for the income group 3201 to 250, the corresponding likelihood of low and medium levels of environmental awareness increase by 7% and 19%. In contrast, the probability of high and very high levels of environmental awareness decrease by 0.4% and 2.6%, respectively.

The marginal effect of TVET education shows that, the odds of respondents being in low and medium levels of environmental awareness decreased by 8% and 12%. However, the chance of being in high and very high levels of environmental awareness increase by 9% and 12%, respectively. Similarly, the probability of low and medium levels decline by 7% and 10% for a minimum of first degree completed. The odds of high and very high environmental awareness are likely to increase by 8% and 9%, respectively.

The marginal effect proves that age determines the level of environmental awareness. Being 50-59 years old, the corresponding probability of low and medium levels of environmental awareness increases by 9% and 12%. In contrast, the chance of high and very high levels of environmental awareness decline by 8% and 13%, respectively. The odds of the medium and very high environmental awareness increase by 12% and decrease by 13%, respectively, for the age between 60-69 years old. The chance of being in the low and medium level of environmental awareness likely

increase by 15% and 16%, while the probability of being in high and a very high level of environmental awareness decrease for the age of 70 to 100 years old.

## 4. DISCUSSIONS

There is high knowledge about river deterioration, air pollution, and forest degradation in Addis Ababa. River pollution is common in most developing countries (Capps, Bentsen, & Ramírez, 2016). Poor sewer and inadequate infrastructure could aggravate the river and stream pollution (Colombani et al., 2018; Liu et al., 2015). Similarly, the quality of air and tree cover reduces following the expansion of industries (Ejaz et al., 2010; Li and Lin, 2015), urbanization (Gasimli et al., 2019; Kleppel, 2002; Li and Lin, 2015), and the population (Li and Lin, 2015). Besides, the respondents have high cognitive skills on the negative contribution of waste disposal and deforestation to wildlife disturbance and soil erosion.

There are high cognitive skills on the effect of wastes on the environment. The cognitive skills on the influence of deforestation on wildlife and soil erosion are also high. Nevertheless, respondents have medium cognitive skills on the cause of acidic rain. There are high and medium attitudes to reduce the consumption of cylinder gas and glass bottles, respectively. It means environmental knowledge, cognitive skill, and attitude vary between respondents because of heterogeneity in their socio-economic status.

Descriptive and ordered logit result shows variation in the level of environmental awareness within the income groups (Duroy, 2005; Ito and Kawazoe, 2017; Strieder et al., 2017). This finding is in line with Xun et al. (2017), Strieder Philippsen et al. (2017) and Altin et al. (2014), yet against Üstün and Celep (2007). This means, the higher the income, the more access to knowledge, cognitive skills, and attitude change. Thus, higher-income led to a high level of environmentally friendly actions (Xu et al., 2019;

Zhang et al., 2015) and is likely to push to demand a better residential environment (White et al., 2007).

Respondents between the age of 17-29 years old have a high and very high level of environmental awareness. The marginal effect also shows the chance of high and very high levels of environmental awareness decline for the age greater or equal to 50 years old. It is against Ziadat (2010), while in line with Aminrad et al. (2013) and Karytsas and Theodoropoulou (2014). Young peoples have better environmental awareness than the elderly. The reasons are as follows, first; they have had better access to information on the environmental damage in Addis Ababa for the last thirty years; second, they passed through the revised educational curriculum, which incorporates environmental items. Third, they are more popular with climate change and global warming in the last thirty years.

Education could influence the level of environmental awareness (Aminrad et al., 2011; Preston et al., 2000), which is against Üstün and Celep (2007). Over secondary education, enhance the level of environmental awareness. Our finding agrees with Karytsas and Theodoropoulou (2014). Similarly, education reduces the low and medium levels of environmental awareness and enhances the high and very high levels of awareness which is in line with Strieder Philippsen et al. (2017), Altin et al. (2014), Ziadat (2010), and Duroy ( 2005).

## 5 CONCLUSIONS

This article provides an insight into the measurement of environmental awareness through environmental knowledge, cognitive skills, and attitude. Besides, to investigate factors that affect environmental awareness, we used an ordered logit model. The questionnaire survey data was applied to conduct our study in Addis Ababa, Ethiopia.

From our empirical analysis, we identify several interesting findings: First, the results of descriptive statistics show that there is a knowledge gap in watershed management, natural resource conservation, and air pollution. Besides, there are also gaps in cognitive skills regards to the cause of acid rain and global warming. Indeed, there is a lack of attitude to reduce the use of glass bottles. Second, the result of the econometric model shows that income, age, and education significantly affect the level of environmental awareness. Hence, creating income-generating activities raises employment opportunities. Having a better income influences their environmental mindset. The respondents' age group also affects the level of environmental awareness. Young peoples have a better awareness than the elderly. Likewise, education influences the level of environmental awareness. The higher the education, the better would be environmental knowledge, cognitive skills, and attitude. In this respect, adult education, short-term training, and workshops are alternative options besides the formal education system to enhance environmental awareness.

This article has some limitations. First, using a quantitative approach is one limitation. Future research may benefit from a mixed approach. Second, the study area is in Addis Ababa. Hence, to get a better image, it would be more pragmatic to include regional cities. It would be sound for future work to use an in-depth interview and ethnographic study.

**Abbreviations**

| | |
|---|---|
| CSA | Central Statistical Agency |
| HH | Household heads |
| EA | Environmental awareness |
| EAr | Environmental awareness for the respondent |
| ETB | Ethiopian Birr |

TVET Technical Vocational Educational and Training

## Declarations

### Ethics approval and consent to participate

Not applicable.

### Consent for publication

Authors agree to conditions of submission, Springer Open's copyright and license agreement and article-processing charge.

### Availability of data and materials

Data would be available on request.

### Competing interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.


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### Authors' contributions

Dagne Getachew**:** Data organization, Conceptualization, Methodology, Analyses, Writing the original manuscript.

Engdawork Assefa: Supervision, conceptualization, Validation, Reviewing and Editing.

Abrham Seyoum: Supervision, conceptualization, Validation.


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Table 1 Respondents' knowledge on the environmental items, Mean (S. D)

| Environmental items | Knowledge, Mean (S.D) | | | |
|---|---|---|---|---|
| | Concepts | Causes | Sources | Effects |
| Water pollution | 3.5 (1.41) | 3.6 (1.35) | 3.2 (1.44) | 4.3 (1.23) |
| River and stream pollution | 3.5 (1.38) | 3.7 (1.33) | 3.4 (1.41) | 4.2 (1.24) |
| Air pollution | 3.3 (1.34) | 3.3 (1.43) | 3.1 (1.47) | 3.9 (1.42) |
| Solid waste pollution | 3.6 (1.32) | 3.6 (1.34) | 3.3 (1.41) | 4.1 (1.28) |
| Forest degradation | 3.6 (1.38) | 3.7 (1.36) | 3.5 (1.47) | 4.3 (1.19) |
| Watershed management | 2.5 (1.43) | - | - | - |
| Conservation of natural resource | 2.9(1.44) | - | - | - |
| Item-test correlation | 0.469 | | | |
| Alpha | 0.9507 | | | |

Table 2 Respondents' cognitive skill on environmental items

| Environmental items | Cognitive skills | | |
|---|---|---|---|
| | *Mean (S.D)* | Item-test correlation | alpha |
| Solar energy contribute to environmental problem | 2.9 (1.66) | | |
| Burning charcoal contribute to GHG emission | 3.1 (1.62) | | |
| Burning fuel wood contribute to GHG emission | 3.3 (1.58) | | |
| Burning oil increase GHG emission | 3.1 (1.60) | | |
| Burning house hold waste contribute to GHG | 3.2 (1.60) | 0.43 | 0.92 |
| Deforestation contribute to GHG emission | 3.6 (1.52) | | |
| Planting trees contribute GHG reduction | 3.7 (1.51) | | |
| Waste thrown into the river harm living organisms | 4.2 (1.34) | | |
| GHG increases the acidity of the rain | 2.7 (1.74) | | |
| Deforestation distort rain fall | 4.0 (1.39) | | |
| Deforestation distracts wild habitat and food | 4.2 (1.27) | | |
| Deforestation cause soil erosion | 4.2 (1.28) | | |
| Cutting of trees accumulate $CO_2$ in the atmosphere | 3.2 (1.69) | | |
| $CO_2$ to trap solar radiation | 2.8 (1.64) | | |
| Atmospheric pollution cause acid rain | 2.8 (1.66) | | |

Table 3 Respondents' attitude on environmental items

| Environmental items | Mean (S.D) | Attitude | |
|---|---|---|---|
| | | Item-test correlation | alpha |
| To reduce the use of glass bottles | 2.6 (1.330) | 0.4075 | 0.8605 |
| To reduce the use of plastic bottles. | 3.1 (1.583) | | |
| To reduce the use of metal bottles | 3.5 (1.629) | | |
| To reduce the use of Naphtha | 4.0 (1.553) | | |
| To reduce the use of cylinder gas | 4.2 (1.528) | | |
| To reduce the use of fuel wood | 3.8 (1.548) | | |
| To increase use of bicycle to travel | 3.9 (1.647) | | |
| To reduce the use of contractual taxi to travel | 3.9 (1.586) | | |
| To reduce the use of a private car to travel | 4.1 (1.587) | | |

Table 4 Socio-economic characteristics and environmental awareness of the respondents

| Variables | Category | Environmental awareness level (%) | | | | | Total | $\chi^2$ | Pr. |
|---|---|---|---|---|---|---|---|---|---|
| | | V. low | Low | Medium | High | V. high | (n) | | |
| Income group n=264 | 0-600 | 0.0 | 8.7 | 34.8 | 43.5 | 13.0 | 23 | 49.22 | 0.002 |
| | 601-1650 | 0.0 | 8.9 | 48.9 | 42.2 | 0.0 | 45 | | |
| | 1651-3200 | 1.4 | 19.2 | 31.5 | 31.5 | 16.4 | 73 | | |
| | 3201-5250 | 0.0 | 6.5 | 30.6 | 53.2 | 9.7 | 62 | | |
| | 5251-7800 | 0.0 | 0.0 | 19.0 | 61.9 | 19.0 | 21 | | |
| | 7801-1090 | 0.0 | 5.9 | 11.8 | 64.7 | 17.6 | 17 | | |
| | over 1090 | 0.0 | 0.0 | 8.7 | 56.5 | 34.8 | 23 | | |
| Family member n=293 | 1 to 5 | 1.1 | 9.4 | 32.8 | 42.2 | 14.4 | 180 | 10.58 | 0.210 |
| | 6 to 10 | 0 | 10 | 10 | 40 | 40 | 10 | | |
| | > 10 | 0.9 | 8.7 | 32.0 | 50.5 | 7.8 | 103 | | |
| Education n=293 | Primary | 1.9 | 14.0 | 37.4 | 40.2 | 6.5 | 107 | 36.25 | 0.000 |
| | Secondary | 1.4 | 11.6 | 39.1 | 42.0 | 5.8 | 69 | | |
| | TVET | 0.0 | 4.8 | 22.2 | 55.6 | 17.5 | 63 | | |
| | Higher Edu. | 0.0 | 1.9 | 22.2 | 46.3 | 29.6 | 54 | | |
| Age group n=280 | 17-29 | 0.0 | 4.5 | 28.4 | 43.3 | 23.9 | 67 | 31.06 | 0.054 |
| | 30-39 | 1.5 | 12.1 | 27.3 | 45.5 | 13.6 | 66 | | |
| | 40-49 | 2.1 | 4.2 | 27.1 | 52.1 | 14.6 | 48 | | |
| | 50-59 | 0.0 | 9.5 | 38.1 | 50.0 | 2.4 | 42 | | |
| | 60-69 | 3.0 | 21.2 | 21.2 | 45.5 | 9.1 | 33 | | |
| | 70-100 | 0.0 | 4.2 | 54.2 | 33.3 | 8.3 | 24 | | |
| Gender n=293 | Male | 0.0 | 5.4 | 24.7 | 49.5 | 20.4 | 93 | 12.12 | 0.016 |
| | Female | 1.5 | 11.0 | 35.0 | 43.0 | 9.5 | 200 | | |
| District n=293 | District 3 | 1.1 | 6.8 | 29.5 | 44.3 | 18.2 | 88 | 10.02 | 0.264 |
| | District 6 | 2.0 | 14.0 | 34.0 | 41.0 | 9.0 | 100 | | |
| | District 8 | 0.0 | 6.7 | 31.4 | 49.5 | 12.4 | 105 | | |

Table 5 Determinants of the level of environmental awareness

| Number of obs. = 252 | | LR chi2(17) =52.31 | | |
|---|---|---|---|---|
| | | Prob. > chi2 = 0.000 | | |
| Log likelihood = -284.21894 | | Pseudo R2 = 0.0843 | | |
| **Variables** | Coef. | Std. Err. | z | P>z |
| **Income group (ETB)** | | | | |
| 0-600 | -0.75328 | 0.381765 | -1.97 | 0.048 |
| 601-1650 | -1.21703 | 0.332743 | -3.66 | 0.000 |
| 1651-3200 | -1.0261 | 0.313493 | -3.27 | 0.001 |
| 3201-5250 | -0.86187 | 0.311043 | -2.77 | 0.006 |
| 5251-7800 | -0.50899 | 0.367378 | -1.39 | 0.166 |
| 7801-10900 | -0.59157 | 0.393753 | -1.5 | 0.133 |
| **Family member (No.)** | | | | |
| 6 to 10 | 0.242077 | 0.395909 | 0.61 | 0.541 |
| Above 10 | -0.04482 | 0.150611 | -0.3 | 0.766 |
| **Educational Level** | | | | |
| Primary | 0.230337 | 0.194481 | 1.18 | 0.236 |
| TVET/College Diploma | 0.588087 | 0.214887 | 2.74 | 0.006 |
| First degree and above | 0.489567 | 0.230648 | 2.12 | 0.034 |
| **Age group (Years)** | | | | |
| 30-39 | -0.38263 | 0.205987 | -1.86 | 0.063 |
| 40-49 | -0.14331 | 0.22975 | -0.62 | 0.533 |
| 50-59 | -0.54445 | 0.238923 | -2.28 | 0.023 |
| 60-69 | -0.54285 | 0.267771 | -2.03 | 0.043 |
| 70-100 | -0.35869 | 0.306406 | -1.17 | 0.242 |
| **Sex** | | | | |
| Male | 0.18405 | 0.1601 | 1.15 | 0.25 |
| **/cut1** | -4.06703 | 0.563799 | | |
| **/cut2** | -2.62726 | 0.451448 | | |
| **/cut3** | -1.49643 | 0.439673 | | |
| **/cut4** | 0.056353 | 0.430167 | | |

Table 6 Marginal fixed effect for the levels of environmental awareness

| Variables | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| **Income group** | | | | | |
| 0-600 | 0.002(0.76) | 0.054 (1.66) | **0.156*(2.05)** | 0.007 (0.14) | -0.219(-1.92) |
| 601-1650 | 0.008 (0.99) | **0.128***(3.31)** | **0.246***(3.97)** | -0.086 (-1.44) | **-0.296**(-2.97)** |
| 1651-3200 | 0.005(1.00) | **0.093***(3.45)** | **0.213***(3.54)** | -0.041(-0.83) | **-0.269**(-2.68)** |
| 3201-5250 | 0.003(0.89) | **0.068**(2.73)** | **0.179**(3.08)** | -0.009(-0.19) | **-0.241*(-2.40)** |
| 5251-7800 | 0.001(0.66) | 0.029(1.22) | 0.101(1.42) | 0.029(0.67) | -0.16(-1.37) |
| 7801-10900 | 0.001(0.64) | 0.036(1.18) | 0.12(1.5) | 0.024(0.5) | -0.181(-1.53) |
| **Family member** | | | | | |
| 6 to 10 | -0.002(-0.66) | -0.030(-0.70) | -0.048(-0.60) | 0.027(0.86) | 0.053(0.56) |
| Above 10 | 0.001(0.28) | 0.006 (0.3) | 0.008 (0.3) | -0.007(-0.29) | -0.009(-0.30) |
| **Education level** | | | | | |
| Primary | -0.003(-0.82) | -0.039(-1.15) | -0.041(-1.21) | 0.047(1.17) | 0.037(1.19) |
| TVET | -0.006(-1.03) | **-0.083*(-2.55)** | **-0.116**(-2.63)** | **0.091*(2.5)** | **0.114*(2.55)** |
| First degree and above | -0.006(-1.01) | **-0.073*(-2.11)** | **-0.095*(-1.97)** | **0.083*(2.11)** | 0.090 (1.95) |
| **Age group** | | | | | |
| 30-39 | 0.003(0.91) | 0.048(1.79) | 0.079(1.83) | -0.047(-1.70) | -0.082(-1.81) |
| 40-49 | 0.001(0.52) | 0.015 (0.61) | 0.030(0.62) | -0.012(-0.58) | -0.034(-0.63) |
| 50-59 | 0.005(0.95) | **0.075*(2.05)** | **0.107*(2.28)** | -0.079(-1.94) | **-0.108*(-2.28)** |
| 60-69 | 0.005(0.9) | 0.074(1.76) | **0.107*(2.09)** | -0.079(-1.64) | **-0.108*(-2.12)** |
| 70-100 | 0.003(0.68) | 0.044(1.03) | 0.074(1.2) | -0.043(-0.92) | -0.078(-1.25) |
| **Sex** | | | | | |
| Male | 0.002(0.81) | 0.026(1.13) | 0.034(1.15) | -0.027(-1.14) | -0.036(-1.15) |

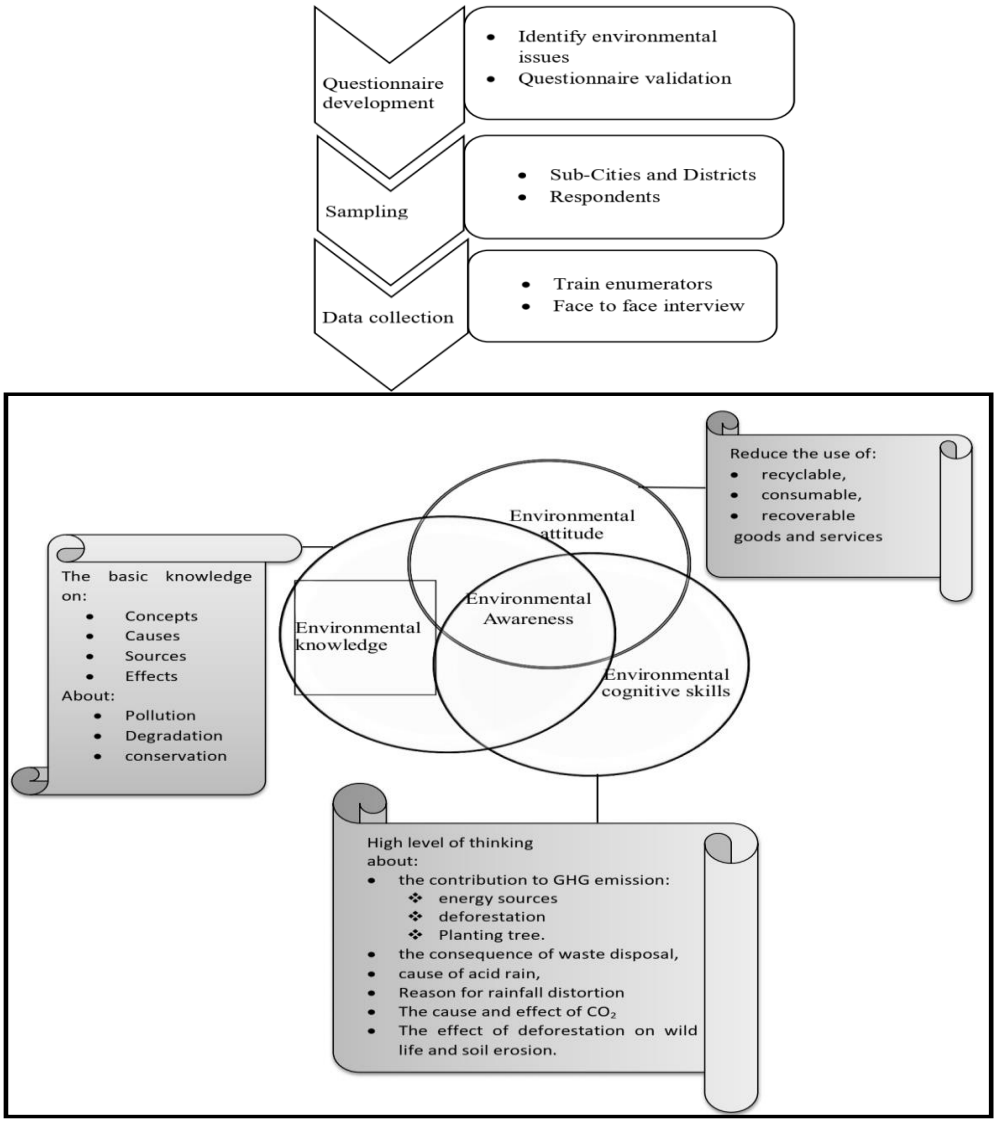


Figure 1 Analytical framework for environmental awareness

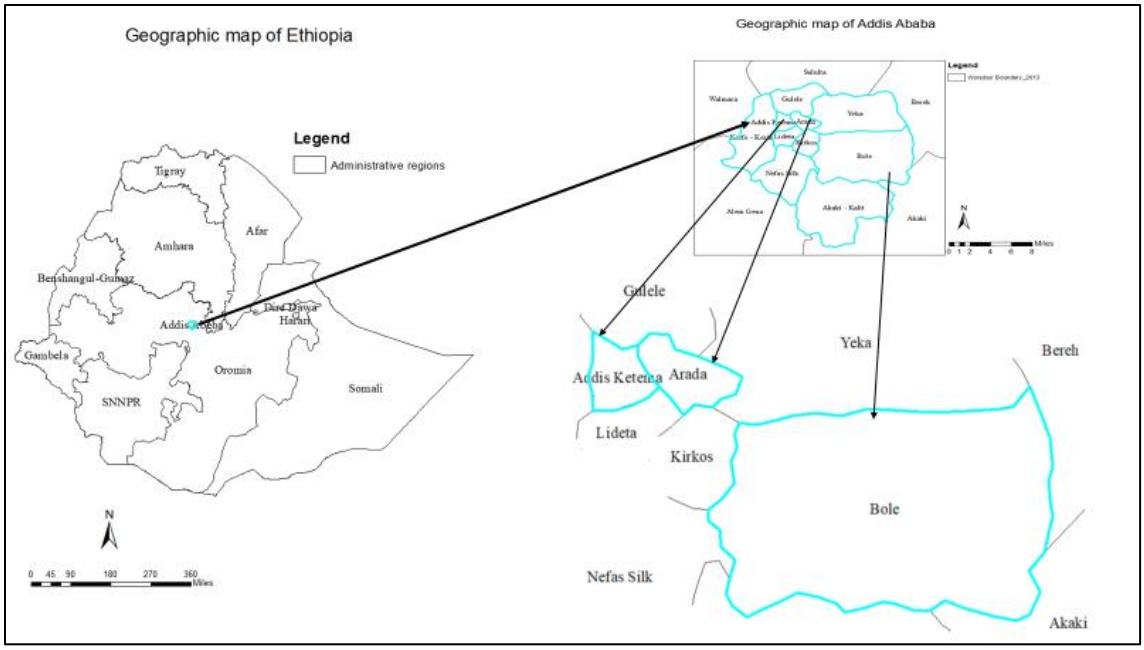


Figure 2. Geographic map of the study area

Source: Own sketch by using ArcGIS 10.5 adopting shape-file from Google search (2020)