https://doi.org/10.17221/94/2022-JFS

Households' willingness to pay for forest conservation in Ethiopia: A review

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Citation: Abdeta D. (2022): Households' willingness to pay for forest conservation in Ethiopia: A review. J. For. Sci., 68: 437–451.

Abstract: Environmental valuation studies in the context of developing countries have become more frequent in recent years. However, literature which reviews and examines the environmental valuation studies is limited. Thus, this paper performed a literature review on forest contingent valuation studies conducted in the Ethiopian context in the past two decades (2000 to May 2022), focusing on two specific objectives: (*i*) to examine amounts of resources that households are willing to pay (WTP) for forest conservation, and (*ii*) to identify determinants of households' WTP. Results indicate the mean lower annual WTP of USD 0.41 (2.63 birr) and 7.04 man-days per household in money and labour time, respectively. Whereas the mean upper annual WTP of USD 53.52 per household in monetary payment and 94.34 man-days per household in labour time contribution are found for the management and conservation of forest in Ethiopia. The finding reveals that there is a limited proportion of the examined studies that included and estimated WTP in a non-monetary payment vehicle, implying a need for future researches on the topic. The result shows that demographic and socio-economic variables, physical assets ownership, institutional and infrastructural services and bid price variables were the main determinants of households' WTP. This suggests that the forest conservation intervention program involving public participation in the country needs to consider the identified determinants of WTP in design and implementation of the program. Moreover, the finding indicates the presence of mixed results on the effect and direction in which some determinants of WTP are affected. This recommends a pressing need for comprehensive future studies on the research theme.

Keywords: contingent valuation method; determinants of willingness to pay; household; forest management; monetary payment; labour contribution

Forest provides various goods and services that support the livelihoods of millions of people, living in and around the forest. Even though the economic contribution of forests to African countries has not got the desired attention from policy makers to ensure budgetary allocation needed for sustained growth of the forestry sector in these countries (Mogaka et al. 2001), the contribution of the sector to gross domestic product (GDP) and national economies is significant. For example, according to the report of UNEP (2016), Ethiopian forests generated economic benefits in the form of cash and in-kind income equivalent to USD 16.7 billion (111.2 billion Ethiopian birr) or 12.86% of GDP in 2012–2013. Of this amount, 6.09% of GDP is accredited to forest industries, whereas the contribution of forest ecosystems to other sectors, particularly agricul-

https://doi.org/10.17221/94/2022-JFS

ture, was found to be 6.77% of GDP. In addition, USD 0.36 billion (2.4 billion birr) was accredited to non-market benefits based on Ethiopians' willingness to pay (WTP) for forest conservation activities/programs (ibid).

Although the forest has such significant benefits, deforestation rate is high and has been increasing in African countries. According to the report of (FAO 2020), Africa experienced the largest annual rate of net forest loss at 3.9 million ha in the years 2010–2020. Ethiopia is among the African countries where deforestation is severe and has a long history, particularly in the central and northern highlands where subsistence farming and settlements have been changing landscapes for a long period of time (Gebrehiwot et al. 2014; Lemenih, Kassa 2014). According to the report of Ethiopia's Forest Reference Level (FRL 2017), the country's forests were experiencing an average annual net loss of 73 000 ha per year over the period 2000–2013.

As an alternative measure to tackle the deforestation problem, the Ethiopian government has demonstrated a strong commitment to increase the forest cover and strengthen the forest contribution to green economic growth. Thus, the government effort is targeted to increase the forest cover from 17.35 million ha of forests covering 15.7% of the national territory in 2015 to 30% by 2025 (MEFCC 2018). Moreover, the Ethiopian government has launched the ambitious Green Legacy campaign in which over 350 million tree seedlings were planted in just a single day with the annual performance of 4 billion seedlings in 2019 (Getahun 2020).

Economic valuation of forest is an important aspect for the conservation of forest ecosystem. In this regard, environmental economists use stated preference (SP) methods to elicit the economic values of non-marketed environmental resources. The method consists of a contingent valuation method (CVM) and choice experiment method (CEM). Almost all of the previous studies conducted on WTP for the conservation of forest resources in Ethiopia used CVM, in which this paper is mainly focused on forest related contingent valuation (CV) studies. [The author used WTP referring to households' willingness to contribute both money (ETB) and labour (man days) to forest conservation, except where it is specified as willingness to pay money (WTPM) and willingness to contribute labour (WTCL).] The CVM is a holistic approach to estimate the conservation value of ecosystem services which asks respondents about the amount of resources they are WTP for the proposed policy or project. The CVM has been used in different areas of application in Ethiopia, for instance to elicit households' WTP for management and conservation of forest resources, (e.g. Mekonnen 2000; Tilahun et al. 2015; Endalew et al. 2020), for valuation of land management and soil conservation (Asrat et al. 2004; Belay 2017; Belay et al. 2020; Alemu et al. 2021), for provision of improved water supply (Belay 2018; Ibsa 2020; Singh 2020) and in the context of public health improvement (Entele, Emodi 2016; Minyihun et al. 2019). However, among these areas of possible application of the method, this review paper focuses on studies that were conducted on local communities' willingness to pay for forest resource management and conservation in the context of developing countries, mainly in Ethiopia.

Prior CV studies reveal that households' WTP for the conservation of environmental resources is affected by different socio-demographic, physical asset owned and institutional factors (Girma, Beyene 2012; Tilahun et al. 2015; Endalew et al. 2020). However, coordinated information on households' WTP for environmental resource conservation and determining factors in Ethiopia is limited. A more recent study by (Abdeta 2022) examined public WTP for forest conservation from a systematic review of prior CV studies conducted in developing countries. However, the study focused more on validity aspects of the prior CV studies, and did not address determinants of WTP for forest conservation. Thus, it is important to examine determinants of households' WTP for forest conservation in order to provide organized evidence on the research theme. Hence, the primary objectives of this paper are to: (*i*) examine amounts of resources households are willing to contribute to forest conservation and payment vehicles used in the WTP value estimation, and (*ii*) identify determinants of willingness to pay for forest conservation and management in Ethiopia. The selected objectives were prioritized as almost all of the CV studies conducted on WTP for forest resource conservation are designed to estimate the amount of resources that households are WTP for forest and identify its determinants.

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MATERIAL AND METHODS

A review of published CV studies conducted on households' WTP for management and conservation of forest resources in the context of developing countries, mainly focusing on studies conducted in Ethiopia, was performed. The scientific research databases, the ScienceDirect and Google Scholar search engines were used to identify English language forest related CV studies available online in full or abstract form from the year 2000 to May 2022. Forest based CV studies published since 2000 or later are included to conduct a review of studies published in the past two decades on the research topic. The search used key terms: willingness to pay, stated preference method, economic valuation of forest resources, forest conservation and management, forest restoration/protection, and forest reservation with contingent valuation method and Ethiopia.

The terms forest conservation and forest management are used in selecting articles and throughout this paper due to that the reviewed studies applied the terms in examining households' willingness to pay. The term forest conservation is defined as the practice of maintaining, protecting, and/or restoring a forest landscape to conserve biological and cultural values, promote sustainable use and equitable distribution of forest goods and services, and ensure the strategic preservation of forest resources for future use (Dudley, Phillips 2006; Pawar, Rothkkar 2015). While sustainable forest management is defined as the practice of sustainable management of all types of forests that will provide a range of economic, ecological and social benefits to the current and future generations (UN 1992; Dudley, Phillips 2006; Chazdon et al. 2016). The evaluated studies presented these terms to respondents using contingent valuation scenarios, in which the definition of the goods to be valued is the important issue to be considered and addressed in CV studies.

The search was conducted using the selected key terms to include prior forest CV studies conducted in Ethiopia. However, some relevant studies from other developing countries were included for comparison with the results from the reviewed forest CV studies conducted in Ethiopia. Studies which report original empirical data, published in peer-reviewed journals and unpublished works such as theses, reports, working papers and other relevant unpublished works were considered and included to provide more evidence on the research topic. The review also considered studies that used a sample from general public and a household level sample, like studies at individual, firm, organizational or other level unit of analysis were not found at the time of the literature search. Hence, the paper included and reviewed 21 forest CV studies for the final synthesis and analysis.

Overview of the contingent valuation method. Public willingness to contribute resources to programs that improve environmental resources is most often measured using a specific survey method known as contingent valuation method (CVM). It is a direct non-market valuation method in which respondents of the relevant population are asked questions about their WTP or willingness to accept (WTA) for use or conservation of ecosystem goods and services. It is called 'contingent valuation' because the valuation is contingent on the hypothetical scenario put to respondents (Perman et al. 2003). The first study that applied the contingent valuation method was conducted by (Davis 1963) to examine values of outdoor recreation. Since then, the method has become a widely applied SP method used for the valuation of a wide range of environmental changes. As compared with indirect methods (Revealed Preference), CVM is seen by many economists as suffering from the problem that it asks hypothetical questions, whereas indirect methods exploit data on observed, actual behaviour. On the other hand, the CVM has two advantages over the indirect method. Firstly, it can deal with both use and non-use values, whereas the indirect methods cover only the former, and involves weak complementary assumptions. Secondly, in principle, and unlike the indirect methods, CVM answers to WTP or WTA questions go directly to the theoretically correct monetary measures of utility changes (Perman et al. 2003).

However, despite its wider application in the valuation of environmental goods and services, CVM has been experiencing intense debates whether the method could provide plausible and valid value estimates that can be used for public decision making. For instance, during 1990, due to the Exxon Valdez oil spill litigation on natural resource damage assessment, CVM got more attention among economists, government and courts. Following the Exxon oil spill damage, the U.S. National Oceanic and Atmospheric Administration (NOAA) convened a "blue ribbon" panel to assess the method. The panel provided a set of guidelines to be fol-

https://doi.org/10.17221/94/2022-JFS

lowed and suggested that under right circumstances (i.e. well-constructed and implemented) the CVM survey could provide useful information and can be used by the court for damage assessment including the passive value (Arrow et al. 1993).

On the other hand, a group of economists proposed the arguments against the validity of CVM, in response to the conditional endorsement of the method by NOAA (Diamond, Hausman 1994; Hausman 2012). For example, Hausman (2012) conducted a "selective" review of CV literature from 1990–2000, entitled "Contingent valuation: From dubious to hopeless" and concluded that the CVM studies conducted by experts in this time frame fail to pass plausibility tests and survey responses are implausible and inconsistent. He argues that this is attributable to three main prolonged CVM problems that continue to occur: (*i*) hypothetical bias "what people say is different from what they do", (*ii*) divergence between WTP and WTA, and (*iii*) failure of scope effects (scope insensitivity) of the method. However, there are other sides that act in favour of the use of the method and argue that a well-designed and implemented CVM survey could provide valid value estimates that can be used for decision making (Carson et al. 2001; Carson 2012; Kling et al. 2012; Haab et al. 2013).

Hypothetical bias is the major topic for the criticism of the CVM in which hypothetical responses tend to overestimate real (actual) responses. The biases that are likely to influence the CV studies are not only limited to the stated hypothetical bias, rather there are other types of potential biases such as starting-point, strategic, payment vehicle biases, and others [for details see Mitchell and Carson (1989), Diamond and Hausman (1994), Hausman (2012)]. Despite the hypothetical bias is likely to occur due to different reasons, respondents' "familiarity" with the goods being valued is the major reason (Mitchell, Carson, 1989; Venkatachalam 2004). Previous meta-analysis studies confirmed the existence of hypothetical bias in CV surveys (List 2001; Murphy et al. 2005; Harrison, Rutström 2008; Foster, Burrows 2017). Hypothetical bias is a divergence between hypothetical responses to CV survey questions and corresponding actual payment (Cummings, Taylor 1999; List 2001; Blumenschein et al. 2008). Hypothetical bias arises as respondents in a CV survey are asked hypothetical questions which tend to produce hypothetical bias in the form of upward bias or overestimation of actual values (List, Gallet 2001; Little, Berrens 2004; Hausman 2012). The hypothetical bias in CV is not only overestimation or inflation of the WTP estimates, as there is evidence that the estimates can be biased downward in the form of conservative responses (Farmer, Lipscomb 2008). The overestimation of the values of the goods in question may lead to higher investment or consumption in terms of other valuable alternative best options (Blomquist et al. 2009).

In response to mitigate or even eliminate the hypothetical bias two ex-ante and ex-post approaches have been developed to calibrate the hypothetical results. The ex-ante approach is an effort to mitigate hypothetical bias in the stage of survey design (Cummings, Taylor 1999; Blomquist et al. 2009; Bonnichsen, Ladenburg 2009). This involves informing the respondents that there are substitutes for the policy available, reminding them about their income constraint, presenting them with a script informing about a tendency to overstate WTP if they were participants of a previous similar hypothetical survey, and notifying the respondents to bear in mind the fact of WTP value overestimation in answering to the CV survey questions.

Whereas, the ex-post approach calibrates hypothetical bias with follow-up questions to the hypothetical valuation questions. Certainty correction is an ex-post approach to mitigate hypothetical bias in which target respondents are asked to rate their degree of certainty in their responses to a hypothetical valuation question on a numerical scale, ranging usually from one to 10, with one representing "very uncertain" and 10 representing "very certain" responses (Champ, Bishop 2001; Morrison, Brown 2009; Foster, Burrows 2017). Hence, the hypothetical responses to the valuation question are then recoded based on the respondents' certainty. Hence, given the highlights on the hypothetical bias calibration approaches which will subsequently be used in evaluating whether the reviewed studies applied the approaches as recommended in literature, this paper performs a literature review of prior forest CV studies conducted in Ethiopia.

RESULTS AND DISCUSSION

Willingness to pay for forest conservation. There are a number of previous CV studies conducted on public willingness to pay for forest conservation in the context of developing countries. The

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studies are mainly aimed to estimate the amount of resources that households are willing to contribute to the conservation and management of forest resources and to identify its determining factors. The studies reveal positive WTP value estimates, and the empirical findings of those prior to forest related CV studies are reviewed and presented as follows. Although this work is mainly focused on CV studies conducted in the case of Ethiopia, some related studies that were conducted in the context of other developing economies were included in the review for comparison of the results from the studies. Table 1 presents value estimates of households' WTP for forest resource conservation and its determinants with the variables' direction of effects on households' willingness to pay.

As presented earlier in the overview of the CVM subsection, calibration of hypothetical bias, typically overestimation of WTP value estimate, is an important issue to be addressed. However, out of 21 included studies, only three (14.29%) studies explicitly reported that they conducted the ex-post, uncertainty correction approach to mitigate the potential hypothetical bias (Mekonnen et al. 2004; Gelo, Koch 2015; Tilahun et al. 2015). For instance, (Tilahun et al. 2015) conducted the uncertainty (certainty) correction model to mitigate hypothetical bias. The study used a ten-point scale with 1 as "very uncertain" and 10 as "very certain", and all Yes/Yes, Yes/No and No/Yes responses were calibrated to No/No responses if the respondents selected certainty scores 1 to 9, in which a large number responses of 339 households were categorized as "No/No" responses. Besides, the study used a protest response identification technique and calibrated for the protest responses. The failure to mitigate hypothetical bias, which is the major limitation of the CVM, implies the importance of calibrating hypothetical bias that got scant attention by most of the CV studies conducted in the country. This may lead to ambiguity in the use of results from the CV studies for valid decision making, which may in turn lead to lessen application of the method in valuation of similar environmental resources. Moreover, only two (9.52%) of the reviewed studies reported that they implemented the ex-ante (cheap talk script) approach to alleviate hypothetical bias (Gelo, Koch, 2015; Kassahun, Taw 2022).

The choice of payment vehicle is an important issue to be considered in elicitation of willingness to pay. Although it is common to use standard monetary payment vehicle in elicitation of WTP, the use of money alone as payment vehicle for a welfare measure in the context of developing countries could lead to a number of problems and inaccurate WTP value estimates (Alam 2006; Tilahun et al. 2015; Gibson et al. 2016). Firstly, in subsistence or low levels of income communities, households may face liquidity constraints to express their preferences. Thus, the resulting WTP estimate is unrealistic and may lead to the underestimation of the value of resources under consideration. Secondly, low income respondents may be unfamiliar with monetary payment which may increase hypothetical bias in the welfare measure (Vondolia et al. 2014; Gibson et al. 2016).

As an alternative measure to address the problems arising from the use of monetary payment alone in the context of developing economies, previous studies used various alternative payment vehicles such as bag of rice (Shyamsundar, Kramer 1996), crop/maize (Mekonnen 2000; Sutton et al. 2008), meals (Diafas et al. 2017), and labour time (Abramson et al. 2011; Tilahun et al. 2015; Endalew et al. 2020). However, most of the previous forest related CV studies conducted in developing countries like Ethiopia failed to include non-monetary payment vehicles such as labour time and they only used the monetary payment vehicle (money) (e.g. Mezgebo 2012; Negewo et al. 2016; Seifu et al. 2017; Getachew 2018; Ariyo et al. 2018; Bamwesigye et al. 2020). As a result, with failure to incorporate non-monetary payment vehicles into WTP elicitation, the estimated values cannot capture actual economic values of the resources in question and may lead to underestimate the welfare measure due to cash constraints in developing countries (Kassahun et al. 2020). This in turn may lead to the depletion of the resource due to neglecting the resource by policy makers.

Although there are some improvements in the inclusion of the non-monetary payment vehicles in estimating WTP for forest resources in the context of developing countries, studies that estimated a non-monetary payment are limited. For instance, the result reveals that only five (23.81%) of the studies reviewed in this paper included and estimated the non-monetary payment vehicle (labour time) contribution in eliciting WTP. For example, a CV study conducted by (Tilahun et al. 2015) estimated public WTP for the conservation of *Boswellia papyrifera* forest, both in money and labour time contribution. The study reported

https://doi.org/10.17221/94/2022-JFS

Table 1. Summary of the findings from review of the included studies

Study	Title	Mean WTP values in USD (birr) and labor in man-day per household per year	Major determinants of WTP and their effect on WTP
Mekonnen (2000)	Valuation of community forestry in Ethiopia: a contingent valuation study of rural households	0.41 (2.63)	households' size (–); income (+); distance of homestead to place of plantation (–); number of trees owned (+); gender (male = 1) (+)
Mekonnen et al. (2004)	Contingent valuation of community plantations in Ethiopia: a look into value elicitation formats and intra-household preference variations	1.25 (10)	household's gender (female = 1) (–); literacy (reading and writing) (+); corrugated roof (+); distance from CPL (–); size CPL (+); no CPL(–); female no CPL (+); bid (–)
Mengistu (2006)	Frontier community valuation for forest patches: The case of Wondo-Wosha subcatchment, SNNPs' Region, Ethiopia	3.48 (30.30)	household's farm land size (+); livestock size (+)
Girma and Beyene (2012)	Willingness to contribute to collective forest management: Evidence from Godere in the Gambela Region of Ethiopia	not estimated	household's age (–); income (+); total land (+); perceived forest destruction (+); perception on responsibility to forest management (+); participation in social institutions and governing (+)
Mezgebo (2012)	Households' willingness to pay for restoring forest resource in Dire Dawa area, Ethiopia	3.52–5.1 (64.82–94.09)	household's gender (male = 0) (–); ownership type (+); education level (+); access to extension service (+); bid (–); income (+); total land owned (+)
Tiruneh (2013)*	Assess communities' willingness to participate in the conservation and rehabilitation of bamboo forests in Bambasi Woreda	3.6–4.03 (67.08–75) 32.88–40.08 man-days	household's age (–); literacy status (+); origin (+); income (+); nearness of plots to forests (+); land size owned (+); total livestock owned (+); contact with extension agents (+); training (+); bids (–)
Ayenew et al. (2015)*	Economic value of Wondo Genet catchment forest in domestic water supply services, southern Ethiopia	17.49–20.41 (360–420)	household's sex (+); education (+); income (+); age (–); family size (–); amount of bid (–)
Gelo and Koch (2015)	Examine the welfare effects of community plantations in Ethiopia using contingent valuation method	1.05–1.60 (20.14–30.41)	households' size (+); household income (+); total expenditure (+); bid price (–); total livestock unit (–)
Temesgen (2015)*	Examine households' WTP for restoration of degraded forest lands in north western Ethiopia	1.03–1.13 (19.18–21.02)	bid (–)
Tilahun et al. (2015)	Contingent valuation analysis of rural households' demand for conserving frankincense forest in Tigray	4.63–5.10 (62.63–85.85) 7.04–8.84 man-days	households' gender(+); age (–); labor (+); annual income (+); initial bid (–); land size (+); shareholding (+); residence(±)
Amare et al. (2016)	Assess perception of local communities on church forests and communities' WTP for management and protection of church forests in Dera district, Ethiopia	1.66 (32)	households' age (+); education (+); access to extension services (+); amount of benefits derived from church forests (+)

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Table 1 to be continued

Study	Title	Mean WTP values in USD (birr) and labor in man-day per household per year	Major determinants of WTP and their effect on WTP
Negewo et al. (2016)	Economic value of forest conserved by local community for carbon sequestration in the Humbo District, Ethiopia	3.09–5.78 (55.73–104.38)	education level (+); marital status (±); years of membership (–); distance from forest site (±); income (+); bid price (–)
Seifu et al. (2017)	Economic valuation of natural forest: The case of Sheka forest, south west Ethiopia	2 (47.97)	households' gender (male = 0) (–); education (+); income(+); bid(–); environmental opinion (+); forest benefit (+)
Yibeltal et al. (2017)*	Contingent valuations of Indigenous timber tree resources: The case of Cheha district, Gurage Zone, Ethiopia	21.08–23.25 (503.28–554.88)	household's income (+); sex (+); training about forest conservation and protection (+); bid (–); distance of households home from the plantation project (–)
Getachew (2018)*	Estimating WTP for forest ecosystem conservation: The case of Wof-Washa forest, North Shewa zone, Amhara Region	15.40–18.21 (426–504)	households' age (+); gender (male = 1) (–); marital status (+); education level (+); income (+); distance (–); bid (–)
Endalew and Assefa Wondimagegnhu (2019)	Determinants of households' willingness to pay for the conservation of church forests in northwestern Ethiopia	6.50 (178) 71.51 man-days	households' income (+); social position (+); membership to mahiber (+); size of the land near to church (+); dependency ratio (–)
Zelalem et al. (2019)	Assess farm households' willingness to contribute labor for conservation of Bamboo forest ecosystem: The case of Mao Komo special woreda Benishangul Gumuz Regional State, Ethiopia	14.15 man-days	households' literacy status (+); age (–); income from bamboo forest (+); contact with extension agents (+); total cultivated land (+); access to credit (+); distance from home to forest (–); bids (–); dependency ratio (–)
Endalew et al. (2020)	Willingness to pay for church forest conservation: A case study in northwestern Ethiopia	8.25 (239.79) 94.34 man-days	initial and follow up bids (–)
Walle and Nayak (2021) *	Estimate forest conservation value as hold by local community using contingent valuation method	4.64 (121.17)	household's education (+); access to extension services (+); farmland ownership (+); forest dependency on (+); membership in community forest management organizations (+)
Kassahun and Taw (2022)	Willingness to pay for conservation of African baobab tree in Ethiopia	3.6 (105)	age (+); initial bid (–); marital status (+); income (+); distance (–); awareness (+)
Lemessa and Chala (2022)	Examine local communities' WTP for improving forest conservation and the determinants in southwest Ethiopia	4.32–53.52	household's educational level (+); income (+); training (+); land position (+); locations of the households from forest edges (±)

*study does not report the equivalent USD value of the estimated mean WTP values in ETB, official exchange rate at the time (year) of survey was used to get the reported USD equivalent values in this study; (–) – negative effect; (+) – positive effect; WTP – willingness to pay; CPL – community plantation

Source: Author's review (2022)

https://doi.org/10.17221/94/2022-JFS

that the upper and the lower bound means of WTP were found to be USD 6.42 (85.85 birr) and USD 4.86 (62.63 birr), respectively. While the upper and the lower willingness to contribute labour (WTCL) was found to be 8.84 and 7.03 man-days per household per year, respectively. However, this study is limited to single forest species (*Boswellia papyrifera* forest), which is small in scope relative to other vast forests in the country, Ethiopia.

Amare et al. (2016) conducted a study to assess the perception of local communities on church forests and investigate the willingness of local communities to pay for the management and protection of church forests in Dera district, Ethiopia. They used a contingent valuation method and Heckman two-step economic model to analyse data. Their result indicates that the majority (70%) of the communities were willing to contribute cash and found that the local households were willing to contribute USD 1.66 (32 birr). Despite this study considered and included the labour time contribution in data collection, the labour contribution was excluded from the model in final WTP estimation. Endalew and Assefa Wondimagegnhu (2019) and Endalew et al. (2020) considered the non-monetary payment vehicle: labour time contribution in estimating households' WTP for the conservation of church forests in northern Ethiopia.

Moreover, literature suggests a need for conversion of the estimated labour time contribution to its equivalent monetary values. The converted equivalent monetary value of estimated labour time contribution can be used in cost-benefit analysis and comparison of the two payment vehicles, monetary and non-monetary (labour time) contributions. Findings from studies that converted the estimated mean labour time contribution to its equivalent monetary values reveals that the converted mean labour time contribution is found to be significantly higher than its corresponding monetary estimates. For instance, (Tilahun et al. 2015) found the higher mean WTP in labour time, 7.17 man-days converted at market wage rate (USD 23.34), which is larger than its corresponding mean WTP in cash (USD 4.86). Similar result was reported by Endalew et al. (2020), when the mean WTP in labour time, 94.34 man-days converted at zonal average wage rate, EUR 72.18 (2 358.25 birr) per year is significantly higher than the mean WTP in cash counterpart, EUR 7.64 (239.79 birr). However, the result indicates that some of the reviewed studies did not convert the estimated labour time to its equivalent monetary value. For example, out of the five studies that elicited the mean WTP in labour time contribution, only three studies converted the estimated labour time to its equivalent monetary values.

Most of the reviewed studies reported WTP values only in local currency, as a few studies reported the values in a commonly used currency, the USD. For studies that did not report the estimated WTP values in USD, the values have been converted into the USD equivalent values, using the official exchange rate of average annual values at a time of survey data collection conducted for the respective studies. The mean WTP is presented both in points and range where possible (i.e. if the required information is reported in the included studies). The WTP estimates were converted to the per year equivalent values for studies that reported WTP values in monthly payment schedule to make the uniform frequency of payment schedule. The per year equivalent WTP estimates for per month values were calculated by multiplying the monthly WTP estimates by 12 months of the year.

Generally, the result indicates that households in developing countries are willing to contribute a substantial amount of resources to forest conservation, despite their low level of income. Accordingly, the findings reveal that Ethiopian households' annual mean WTP values are ranging from USD 0.41 (2.63 birr) (Mekonnen 2000) to USD 53.52 (Lemessa, Chala 2022) in the form of monetary payment vehicle. Whereas households' mean willingness to contribute labour time ranges from 7.04 (Tilahun et al. 2015) to 94.34 (Endalew et al. 2020) man-days per household per year. The results reveal a divergence of the WTP value estimates among studies. This may attributed to the difference in the year in which those studies were conducted, the forest conservation context (i.e. proposed CV scenario during WTP elicitation), elicitation format/methods used and other relevant parameters.

Compared to relevant studies from other developing countries, the estimated lower and upper bound mean WTP values from included studies show mixed results. For instance, the lower limit mean monetary WTP value (USD 0.41) is comparable in magnitude with findings from (Adams et al. 2008), who reported the annual mean WTP value of USD 1.08 for the conservation of Morro do Diabo State Park and Atlantic Rainforest, São Paulo State, Brazil, and (Ariyo et al. 2018), who found the annual mean WTP value of USD 3.84 per

https://doi.org/10.17221/94/2022-JFS

household in Nigeria. On the other hand, the upper bound WTP value (USD 53.52) reported in this review is significantly different from the annual mean WTP value of USD 75.36 per household reported by (Gordillo et al. 2019) from a nationwide CV survey in Ecuador. Another study conducted by (Bamwesigye et al. 2020) in Uganda estimated willingness to pay for forest existence value and sustainability, and reported the annual mean WTP value of USD 15 per household.

Determinants of willingness to pay. Results from CV studies on public WTP for forest conservation indicate that WTP is influenced by several sets of explanatory variables. For the sake of ease of understanding the analysis conducted in this paper, these variables are categorized as demographic and socioeconomic determinants, institutional and infrastructure services determinants, physical asset ownership determinants and bid price. Most of the prior CV studies used willingness to pay as a dependent variable and with above-mentioned predictors. A complete summary of empirical findings from the included studies on the determinants of WTP is presented in Table 1.

Demographic and socioeconomic determinants of WTP for forest conservation include age, gender, family size, education level and income of respondents (Tilahun et al. 2015; Seifu et al. 2017; Ariyo et al. 2018; Getachew 2018). The findings from many sources of empirical literature (Girma, Beyene 2012; Seifu et al. 2017; Getachew 2018; Endalew, Assefa Wondimagegnhu 2019) reveal the presence of a significant linkage between the socioeconomic characteristics of the respondents and their WTP for forest conservation management.

The findings suggest that the age of the household head has a negative significant effect on households' WTP for forest conservation (Girma, Beyene 2012; Tilahun et al. 2015). This indicates that an increase in age is linked to a decrease in WTP for forest management. Contrasting to these findings, Ansong and Roskaft (2014), Amare et al. (2016) and Getachew (2018) reported a positive effect of age on households' WTP for forest conservation. This implies that the younger the age of the household, the more resources they are willing to contribute to management of forests. This may be attributed to the fact that the younger household may have a longer planning time horizon and hence, they may be more likely willing to invest more resources for the conservation and management of forest than the older one. These contrasting findings suggest a need for further studies on the research theme.

There is a mixed finding regarding effects of the education level on WTP. The results of most of the CV studies reviewed in this paper indicate that a higher education level is correlated with higher WTP for forest conservation program. This implies that the more educated the household, the more awareness about benefits of improved environment and it is more likely willing to support the program. The empirical findings of Seifu et al. (2017) and Getachew (2018) reveal positive effects of education on households' WTP for the conservation of church forest and Wof-Washa forest in Ethiopia, respectively. In contrast, Ariyo et al. (2018) reported a negative significant effect of the education level on households' WTP for forest conservation in Ibadan, Oyo State, Nigeria. Whereas (Bamwesigye et al. 2020) found an insignificant effect of respondents' education level on WTP money for forest existence value and sustainability in Uganda. They attributed the finding to that most of the respondents in the area are not educated. Hence, the mixed result regarding the effect of the education level on households' WTP for forest conservation suggests the need of rigorous future studies to reach a conclusive outcome.

The income of the household head is found to be a significant determinant of household's WTP for forest conservation and management in almost all studies reviewed in this paper. For example, empirical results from the studies by Girma and Beyene (2012), Tilahun et al. (2015), Seifu et al. (2017), Ariyo et al. (2018), Gordillo et al. (2019), and Kassahun and Taw (2022) reported that the income has a significant positive effect on WTP money for forest conservation and management. This implies that the higher the income of the households, the more likely they are willing to pay money for the conservation of forests. This review observed a consistent and conclusive result in different CV studies on the positive effect of household income on WTP for forest conservation in developing economies.

Institutional and infrastructure services include: distance of the homestead from the forest area, membership in a forest management association, communities' perception of the current forest status, access to credit and training on natural resource conservation (Girma, Beyene 2012; Tilahun et al. 2015; Endalew and Assefa Wondimagegnhu 2019). Distance of the homestead from the for-

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est area is found to be a significant determinant of households' WTP for forest management and conservation. The empirical results from Getachew (2018) and Endalew and Assefa Wondimagegnhu (2019) reported that the homestead distance from the forest area has a negative significant effect on households' WTP for forest conservation and protection. This is due to the assumption that, as the distance of the respondents' residence increases, the more inaccessible the benefits from the forest area, which in turn decreases the probability of WTP for the forest conservation.

Communities' perception of the current forest status (e.g. perceived by respondents as: in good condition, deteriorating or others) is found to have a significant effect on WTP for the forest conservation. For example, Girma and Beyene (2012) found that forest deterioration has a negative effect on households' WTP for the conservation of forest in Ethiopia. This is attributed to the fact that the perception of deterioration can create an impression that spending money and time is recognized as wastage of efforts, and its anticipation is impossible to reverse the deteriorated resource and realize the rehabilitation of the resource.

A physical asset owned by the household comprises total land and livestock owned. Findings reveal that the variables of the physical asset owned (total land and livestock) are significant determinants of household's WTP for forest conservation (Girma, Beyene 2012; Mezgebo 2012; Gelo, Koch 2015; Zelalem et al. 2019). Results of studies reveal that an increase in the hectare area of total land owned by the household is correlated with higher WTP for forest resource conservation and protection. For example, Girma and Beyene (2012) and Tilahun et al. (2015) reported that the land owned by the household has a positive effect on households' WTP for the forest conservation program in Ethiopia. This is so perhaps as households with the larger area of land do not need to clear forest to expand their land since they have enough land for cultivation and support the protection and conservation of the forest ecosystems.

The bid price offered is found to be a significant determinant of households' WTP for the forest ecosystem conservation in developing economies (Ethiopia). The finding indicates that the presence of conclusive results on increases in the bid price was associated with lower WTP in almost all the studies reviewed in this paper (e.g. Gelo, Koch 2015; Tilahun et al. 2015; Ariyo et al. 2018; Gordillo et al. 2019; Endalew et al. 2020; Kassahun, Taw 2022). This supports the economic theory of the law of demand, implying that the higher the amount of bid price offered to the respondents, the less likely they are willing to pay the bids for conservation practices of forest ecosystems.

Research gaps and future research direction. Despite questions regarding the credibility of results from a contingent valuation survey are common for the CV studies in general, it is a concerning issue for the studies conducted in the setting of developing countries in particular. This is attributed to that most of the CV studies in developing countries failed to follow the recommended set of best practice guidelines in application of CVM for non-market valuation of environmental resources (Whittington 2002, 2010; Whittington, Pagiola 2012). For instance, Whittington (2002) indicated that CV studies in developing countries are "so bad" for so many reasons: (*i*) the CV survey itself is often poorly managed and executed, (*ii*) the CV scenarios are often poorly constructed, and (*iii*) few CV studies conducted in developing countries are designed to test whether some of the key assumptions made by the researchers were correct and whether the results are robust in relation to simple variation in research design and survey method. Besides, Durand-Morat et al. (2016) reveals that researchers who are conducting CV studies in developing countries face different challenges such as sampling challenges, survey methods and implementation, selection and training of the local personnel, elicitation method, literacy rate of the population and security issues challenges, recruitment of participants, and participant compensation challenges.

However, appropriate research design and implementation of the CV survey instruments have a potential to alleviate the above-mentioned problems and results in credible value estimates from the CV studies. Hence, this study carried out a literature review of prior forest CV studies conducted in the context of developing country, Ethiopia, in the past two decades. A finding indicates that most of the reviewed CV studies lack a proper research design and accurately implemented CV survey as per recommended in stated preference literature. Based on the findings of this paper, the existing potential research gaps and future research direction are presented and generalized as the following points.

Regarding the choice of appropriate payment vehicles, in the existing studies on households' WTP for

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forest conservation in Ethiopia, only some of them estimated WTP in non-monetary payment vehicles such as labour time contribution. The failure to consider and include the non-monetary labour time contribution may lead to underestimation of the actual economic values of the goods in question. This is likely to exist because the respondents are not able to freely express their actual preference for the goods due to the obvious limited cash for low-income households in developing economies (Eom, Larson 2006; Hung et al. 2007; Rai, Scarborough 2015). For instance, findings of the reviewed studies that estimated WTP in both payment vehicles reveal that the mean WTP estimate in labour time converted to its equivalent monetary value is much greater than its corresponding monetary mean WTP estimates. This implies that such a substantial amount of resource contribution in labour time is likely to be lost if the labour contribution was not included in the estimation. Thus, it is strongly recommended that future researches will have to include labour contribution in addition to the monetary payment vehicles, as the low-income and large labour households are more likely to contribute in labour time.

The mitigation of a potential hypothetical bias is considered and performed in a small proportion of the included studies in their application of the CVM for WTP estimation. Despite the ex-ante survey design and ex-post calibration approaches are arguably effective techniques developed to minimize or even eliminate the hypothetical bias in CV survey (Murphy et al. 2005; Morrison, Brown 2009; Loomis 2014; Lawton et al. 2020), most of the reviewed studies failed to apply these techniques. This implies that the impending hypothetical bias in hypothetical CV studies and a need for its alleviation using the existing mitigation techniques got scant attention. This may lead to lessening the credibility of results from such CV studies to use for decision making, which could in turn hinder the application of the method in valuation of non-market goods and services. Thus, it is recommended that future studies on the topic will need to diagnose and mitigate the likely hypothetical bias in hypothetically constructed CV scenario/survey instruments.

Finally, the finding indicates the presence of mixed/inconclusive results regarding the effect and direction in which some predictors affect households' WTP for forest conservation and management. For instance, results from the empirical findings of some studies reviewed in this paper indicate that variables such as age of the household head, gender, education level and distance of respondent's residential place from the forest site are found to affect the household's WTP for forest conservation both positively and negatively. This finding implies a need for a comprehensive future research to provide conclusive evidence on the topic. Moreover, the results suggest that the forest conservation policy/program encompassing public involvement in the country will need to consider the identified determining factors of households' WTP for forest conservation in the design and implementation of the program.

CONCLUSION

This paper examines the amounts of resources that households are willing to pay for forest conservation, and identifies main determinants of WTP from a review of previous forest CV studies conducted in the context of developing economies, Ethiopia. Results reveal that almost all of the previous studies reviewed in this paper used the contingent valuation method (CVM) of the stated preference valuation technique to estimate households' WTP for forest conservation and management. The findings from the reviewed studies show that there is a direct linkage between households' WTP and forest conservation. This implies that the CVM is an appropriate technique and can be applied to determine WTP for forest conservation, since local communities recognize and give value to the environmental services of the forest and are willing to maintain those benefits. The result further indicates that despite Ethiopia is a low income country, local communities are willing to contribute significant amounts of resources in both money and non-monetary payment such as labour time for the conservation of forest resources on a sustainable basis.

Households' WTP for forest conservation depends on different socio-economic factors, institutional and infrastructural factors and physical assets ownership variables. Hence, household head's education level, income, labour, total land size, total livestock, shareholding, perception of forest destruction, perception of responsibility for forest management, access to extension service, forest benefit, environmental opinion and social position are the major determinants of households' WTP that are directly/positively linked to WTP. Dependency ratio, family size and marital status of the household head are determining factors that are inversely related to house-

https://doi.org/10.17221/94/2022-JFS

holds' WTP. Whereas household head's gender, age and distance of the respondent's residential place from the forest edge (site) affect households' WTP for forest conservation both positively and negatively as reflected in the findings of different studies. This finding implies the presence of inconclusive results regarding the effect and direction of the effects of these determinants on WTP, which suggests a need for further studies on the research theme.

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Received: July 19, 2022
Accepted: September 30, 2022
Published online: November 1, 2022