https://doi.org/10.17221/74/2023-JFS

Applying the European Union (EU) assessment initiative of forest sustainability in Africa: A case study of the timber harvesting impact on the environment in Sierra Leone

Petra Hlaváčková[1], Sheku Kemoh Mansaray[1], Samuel Antwi Darkwah[2], Iva Živělová[2]*

[1]*Department of Wood Products Economics and Policy, Faculty of Forestry and Wood Technology, Mendel University in Brno, Brno, Czech Republic*

[2]*Department of Regional and Business Economics, Faculty of Regional Development and International Studies, Mendel University in Brno, Brno, Czech Republic*

**Corresponding author: kemzo4real@gmail.com*

Citation: Hlaváčková P., Mansaray S.K., Darkwah S.A., Živělová I. (2024): Applying the European Union (EU) assessment initiative of forest sustainability in Africa: A case study of the timber harvesting impact on the environment in Sierra Leone. J. For. Sci., 70: 79–90.

Abstract: The European Union (EU) provides both financial and expert support for sustainable forest management initiatives and also boosts compliance with such initiatives in Africa. Thus, there is a need to monitor the progress of implementing such initiatives. The objective of this paper is to describe the role of timber harvesting entities in environmental impact discussions, and to also identify the role of EU institutions in promoting forest sustainability in Sierra Leone. Data were collected in a controlled survey from four communities, using a questionnaire formulated according to guidelines recommended by Babbie and Mouton (2010). The reliability test shows a 0.68 internal consistency among the latent variables (Cronbach alpha test). The selected four communities were Bambawo, Dia, Basara, and Menima, with a population of 6 000, 5 400, 7 500, and 5 600 inhabitants, respectively (Stats SL 2021). A Confirmatory Factor Assessment (CFA) was used for a descriptive statistical analysis of the data. The results showed that the environmental impact has an eigenvalue of 1.08, where only variables with a factor loading exceeding 0.5 were used. The paper concludes with discussions and relevant recommendations on mitigating the impacts of timber harvesting on the environment within the study area.

Keywords: climate change; forest management; knowledge transfer; mitigation; sustainable forestry

The efforts of governments to utilise forest products for socio-economic development have led to environmental challenges, and the highlights of such challenges are well noted by Agbo et al. (2015) and Kamara and Su (2018) – both studies concluded that, between 1990 and 2005, Sierra Leone lost 10% of its forest cover. It seems that the Sierra Leone government is not concerned about whether timber harvesting is undertaken in compliance with sustainable forest principles, but rather gives preference to maximising economic gains. Successive government policies from 1988 to the early 2000s hovered around bans on timber exports, apparently to promote local processing and employment. In August 2007, the government also banned the felling, processing, and export of timber with the goal of curbing the overuse of forest resources and the loss of revenue

https://doi.org/10.17221/74/2023-JFS

caused by the expansion of illegal forest activities (Chukwuone et al. 2008; Akomaning et al. 2022). This ban was lifted in 2008 and was reinstated in 2011. In April 2018, there was also a blanket log export ban in response to the 2017 mudslide disaster that killed over 300 people and displaced more than 3 000 residents (Stats SL 2021). Kamara and Su (2018) opined that the timber export ban was not a viable sustainable policy for forest management in Sierra Leone. Many other factors may influence this conclusion, but the following reasons account significantly for the failure of the bans. Firstly, while the ban reduces the country's level of production and export of industrial round wood, it does not reduce the domestic consumption of sawn wood, fuel wood and other wood products. It is, therefore, obvious that the deforestation rate will continue to increase even with the ban in place. Moreover, the policy might lead to an increase in deforestation as domestic processing companies compete against each other to meet the domestic market demand for the supply of wood products. Another factor is that the ban also led to illegal cross-border timber trade. Domestic wood processing companies might seek alternative markets in other countries to sell their excess goods. Thus, a log export ban cannot simultaneously achieve conservation and economic goals for Sierra Leone. It can, however, be very useful in saving the remaining forests of Sierra Leone with adequate supervision of the domestic harvesting of timber (Gianvenuti, Vyamana 2018; Kamara, Su 2018). Sierra Leone is globally recognised as a biodiversity hotspot, and the country is rich in indigenous flora and fauna, including important endemic species and internationally rare or threatened species (Kamara, Su 2018). Unfortunately, the poor economic situation and environmental degradation, mainly due to deforestation, remain the major challenges for the country. There is a general consensus that while it is significant that the government pursued policies that created jobs, increased economic growth, and reduced unemployment; it should have also implemented policies that cater for the protection of its environment (Salmivaara et al. 2018). The EU and other relevant bodies, through various institutions, have invested resources in African countries to comply with sustainable forest management principles and mitigate the hazards of pollution in the environment that included assessment initiatives to monitor and encourage such drives. Based on such support, this paper sought to describe the role of timber harvesting entities in environmental impacts discussions, and to also identify the role of EU institutions in promoting forest sustainability in Sierra Leone. However, the country remains one of the most vulnerable countries to the effects of climate change in the world (Zhang et al. 2016; Eckstein et al. 2018). The country has a land area of 72.3 thousand km^2. The percentage of forest cover from the total land area is 35.1% (Munro, Horst 2012; Namuene, Egbe 2022). Table 1 shows the West African countries by forest cover in 2020.

According to The Food and Agriculture Organization Corporate Statistical Database country reports (FAO 2015), changes in forest cover among the Mano River Union countries (Sierra Leone, Guinea, and Liberia) were pretty similar. Between 1990 and 2010, Sierra Leone lost an average of 19 300 hectares of forest per year, an average annual deforestation rate of 0.63% (Howard et al. 2016; Grootaers, Bortelot 2017). Within this same period, the country lost 9.5% of its forest cover. In terms of habitat conversion within the same period, there was a 17.7% loss of forest and woodland habitat (Jackson et al. 2008; Kamara, Su 2018).

Table 1. West African countries by forest cover (%), 2020

Status	1	2	3	4	5	6
Forest cover (%)	very low	low	modest	adequate	high	very high
	0–5	6–10	11–20	21–30	31–50	51+
Countries	Mauritania, Niger	Togo, Benin	Mali, Cape-Verde	Burkina Faso, Nigeria, Ivory Coast, Gambia, Guinea	Liberia, Senegal, Sierra Leone, Ghana	Guinea-Bissau

Source: World Bank (2020)

https://doi.org/10.17221/74/2023-JFS

In Liberia, the change in forest cover between 1990 and 2010 saw an average loss of 30 000 ha or 0.61% per year. In total, the country lost 12.2% of its forest cover (Howard et al. 2016). Similarly, in Guinea, between 1990 and 2010, there was an average loss of 36 000 ha or 0.50% per year. In total, Guinea lost 9.9% of its forest cover (Salmivaara et al. 2018). As opined by Sampson et al. (2019), this supports the essence of knowledge transfer from EU countries to Africa to mitigate the rapid rate of forest loss by ensuring compliance with sustainable forest principles.

Sierra Leone and international protocols on climate change. Sierra Leone ratified the Paris Agreement in November 2016 and the Kyoto Protocol in November 2006. Thus, it became incumbent for the country to maintain relatively low (close to the world average of 7.58 $MtCO_2e$) emissions by 2035 or be carbon neutral by 2050. The recent intervention by the government has led to robust policies and strategies to address greenhouse gas (GHG) mitigation through clear specific processes, such as: the institutionalisation of coordination, monitoring, reporting, and verification of climate change issues; transformation of the National Meteorological Services of Sierra Leone and the strengthening of the climate change Early Warning System of Sierra Leone; promotion of energy efficiency, enhanced management and expansion of the energy mix through the uptake of renewable energy sources (solar, wind, hydro, biomass), particularly in the rural areas of Sierra Leone; enhancement of waste management systems at all levels to reduce pollution and greenhouse gas emissions under the category of improving the health of both humans and animals and, also to reduce global warming; diversification of economic growth through strengthened infrastructure that contributes to the reduction of regional and global emissions of GHGs and building a stable economy; adoption and application of climate-smart and conservation agriculture through best agricultural practices that enhance the soil fertility and improve crop yield (Wadsworth, Lebbie 2019; Government of Sierra Leone-2021).

These radical policies are geared towards compliance with the 1992 Earth Summit (UN Department of Economic and Social Affairs 1992) that resulted in the ratification of three main conventions: The United Nations Framework on Climate Change (UNFCC); the Convention on Biodiversity (CBD); and the United Nations Convention to Combat Desertification (UNCCD). The CBD is concerned with forests as the habitat for many of the world's plant and animal species. The UNFCCC recognises forests as an absorb hub that can mitigate the effects of human pollutants contributing to climate change. Finally, the UNCCD recognises the role of forests in preventing desertification and drought. Thus, the Rio Summit represented a major step forward in multi-lateral environmental agreements as it marked the first concerted attempt to link priorities for economic development with environmental protection (Ajake, Enang 2012; Bamwesigye et al. 2021).

Notwithstanding all the interventions from international bodies, Sierra Leone and other West African countries have only made very little progress in the area of GHG emissions, but it has become a relevant policy discussion. Between 1990 and 2014, the West Africa region's total GHG emissions increased by 17%, from 847.46 $MtCO_2e$ to 897.31 $MtCO_2e$ (FAO 2015). Within the sub-region, six countries (Equatorial Guinea, Cape Verde, Cote d'Ivoire, Gambia, Chad, São Tomé and Príncipe) experienced significant growth in GHG emissions, ranging between 100% and 300% from 2000 to 2021 (Ajake, Enang 2012; Uzu et al. 2022). In five countries (Mali, Niger, Burkina Faso, Senegal, Guinea), emissions grew from 40% to 66% within the same period. In eight other countries (Sierra Leone, Togo, Mauritania, Guinea Bissau, Nigeria, Ghana, Benin, Cameroon), GHG emissions grew from 4% to 32% (Obasi et al. 2015). Nigeria contributed 46% of the West Africa region's total emissions, with an average annual change in emissions of + 1%. Emissions from Cameroon grew on average by 0.2% annually (Eckstein et al. 2018; Uzu et al. 2022). Table 2 shows the comparative climate indicators in three West African countries of Sierra Leone, Guinea, and Liberia (The Manor River Union Countries) in 2000.

In Africa, as in other continents, threats of climate change have resulted in a variety of scientific studies in this field. Obasi et al. (2015) provided an evaluation of the socio-economic and environmental effects of timber harvesting in Nigeria through a structured questionnaire. Furthermore, a similar work conducted by Energy for Opportunity (EFO) and compiled by Munro and Horst (2012) identified the dangers of deforestation and climate change. Both these works agreed

https://doi.org/10.17221/74/2023-JFS

Table 2. Comparative climate indicators of Sierra Leone, Guinea, and Liberia in 2000

Country	Total GHG emission	Global emission (%)	Population	CO_2 per capita	GDP (million USD)	$CO_2 \cdot GDP^{-1}$ (million USD)	Change in GDP emission
Sierra Leone	3.51	0.01	4 390 737	0.08	1.654	2.122	3.14 (+32%)
Liberia	12.85	0.03	7 079 162	1.81	3.987	3.222	–12.72 (–78%)
Guinea	30.18	0.06	11 805 509	2.56	5.254	5.744	8.60 (+40%)

GDP – gross domestic product; GHG – greenhouse gas
Source: Nduche et al. (2000)

that timber harvesting is a major cause of deforestation, which poses a major challenge to forest sustainability across Africa.

Hypothesis. Environmental impacts from timber harvesting are caused by neglecting forest sustainability principles.

Objectives. The main objective is to describe the role of timber harvesting entities in environmental impact discussions. Another objective is to identify the role of EU institutions in promoting forest sustainability in Africa.

MATERIAL AND METHODS

This paper is based on primary data collected through a structured questionnaire. It covers the demographic characteristics of formal forestry industry players, timber harvesting firms and their Corporate Social Responsibilities (CSRs), challenges associated with timber harvesting, and the environmental impact that comes along with timber harvesting. A total of 301 questionnaires were completed. The exercise lasted for two weeks. The confirmatory factor analysis (CFA) procedure is used for a pool of variables, and only variables with a factor loading of 0.5 and above are considered. Kambui Hills forest reserve is a low-lying range of hills that can be found on the west of Kenema and extends to other districts. It occupies a land area of 21 228 ha, that is 40 km in length and 5 km in breadth (Cerutti et al. 2015).

The sampling technique is a multi-stage sampling technique. Four towns with a population of 25 500 inhabitants were selected for a structured questionnaire. The conducted reliability test shows a 0.68 internal consistency among the latent variables from the Cronbach alpha test. The study sample size was calculated using the formula propounded by Krejcie and Morgan (1970). A simple descriptive statistical technique is used to present the research findings, using figures and tables. We used 0.05 as the degree of accuracy and a 95% confidence level. This conforms with the Krejcie and Morgan table in terms of representative sampling. The four communities were Bambawo with a population of 6 000, Día with a population of 5 400, Basara with 7 500, and Menima with 5 600 (Stats SL 2021). It is acknowledged that the minimum sample size required for estimating population proportions with specific accuracy and confidence is an important consideration in empirical research. The correct calculation of the minimum required sample size is (n = 385). This is based on the standard error formula for a 95% confidence level and a 2.5% margin of error. However, it is important to also consider that sample size determination is a multifaceted process with various factors, including the study objectives, available resources, missing data and the population size. In this context, there is an academic rationale for the chosen sample size of 301 respondents. With a population of the entire Kambui Hills Forest Reserve (KHFR) slightly above 45 000 inhabitants, a sample size of 301 still represents a statistically significant proportion of the population. Although Krejcie and Morgan (1970) suggest a sample size of 385 for a population of this size, the sample size used for this work is still within an acceptable range, considering the practical constraints. The map of the forest reserve is shown in Figure 1 with the KHFR depicted in green.

The questionnaire was pre-tested with five people in each of the two communities (Bandama and Serabu) outside the study areas. The variables that had 0.5 factor loadings and were considered for the assessment are the loss of biodiversity, silting of rivers and lakes, damage to trees and non-wood products, the disappearance of vegetation, pollution, climate change and global warming. The instrument of the

https://doi.org/10.17221/74/2023-JFS

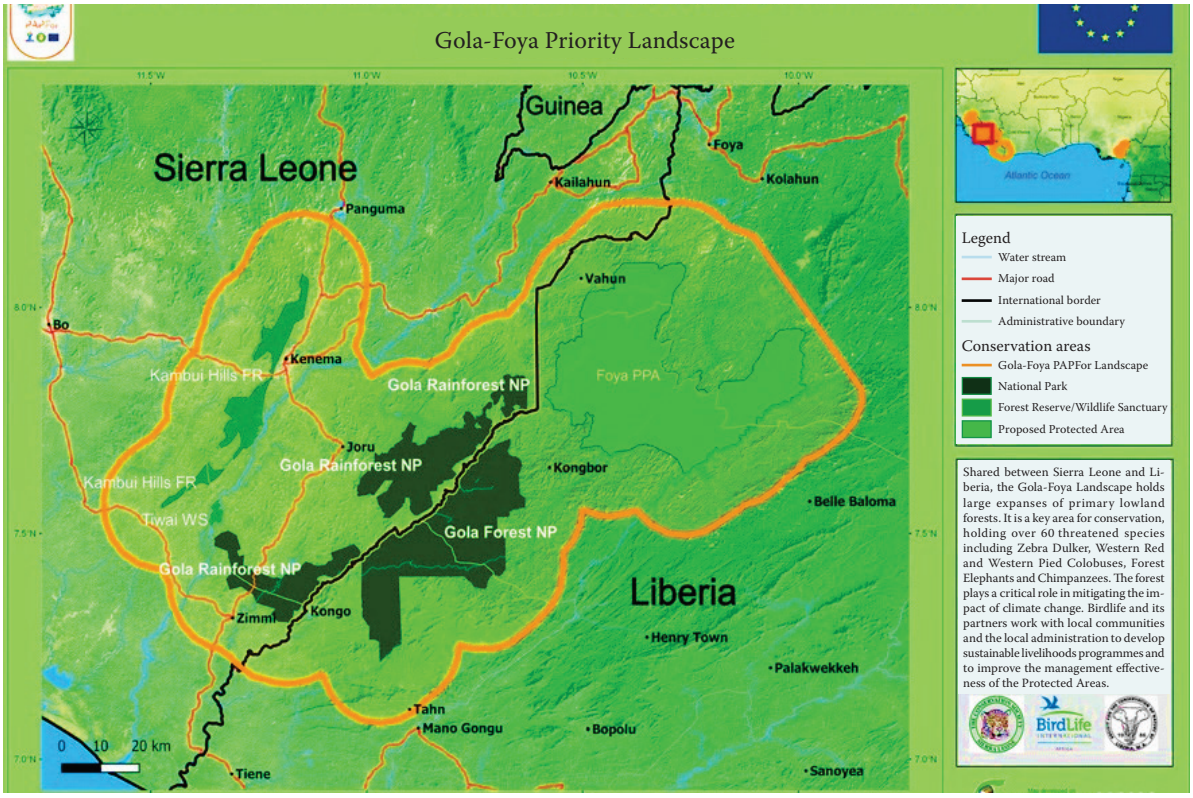

Figure 1. Gola Forest landscape showing the Kambui Hills Forest Reserve

Source: The EU support programme for the preservation of forest ecosystems in West Africa (Maminiaina et al. 2020)

questionnaire also covers the firms' CSR, the process of initiating the firms' CSR, the stated laid down initiatives, the objectives of the firms' CSR, the duration of the CSR implementation and measures to ensure sustainability in compliance with forest principles.

RESULTS

This section provides results from the CFA of the demographic characteristics of the formal forestry industry players. The demographics are shown in Table 3.

The results in Table 3 show that the average age of the formal forestry worker is 42.1 years. The standard deviation (SD) is 12.7. Out of a 7.21 mean score for the household size, there is a 3.6 standard deviation. The difference in the mean between the females and males implies that females dominate the males in a household. The working age bracket provides an interesting result as the average mean of the household members between the ages of 15 and 65 years is 3.9 with a SD of ± 2.51. The age brackets of 1 to 15 and from 65 years form the dependent group within the households. The average mean of people who are literate is 3.1 with a SD of 2.3. Out of the mean average of 3.1 literate people, 1.6 were males and 1.5 were females. Furthermore, the average number of people employed has an average mean of 2.5 with a SD of 0.2 while the average mean of people unemployed is 3.9 with a SD of 2.6. Table 4 shows demographics such as household size, gender characteristics, and literacy, expressed in frequencies and percentages.

The sociodemographic characteristics of the respondents are expressed in frequencies and percentages in Table 4. The survey shows that the number of male respondents was just three percent dominant over the number of female respondents, with 154 male respondents constituting 51.16% of the respondents and females constituting a minority of the respondents (147), which makes 48.84% of the respondents. The results further revealed that the majority of the respondents have an elementary education, and this represents 80.1% of the total respondents. Only 0.33% of the respondents have no formal education and these were in the minority among the respondents. The findings also revealed that most of the respondents were mar-

https://doi.org/10.17221/74/2023-JFS

Table 3. Household characteristics of the respondents

Variable	Mean	Standard deviation	Minimum	Maximum
Age	42.1	12.7	1	89
Household size	7.2	3.6	1	26
Males in household	3.6	2.3	0	19
Females in household	3.8	2.0	0	16
Age below 15 years	3.1	0.2	0	12
Males below 15 years	1.6	1.5	0	8
Females below 15 years	1.7	1.3	0	5
Age 15–65 years	3.9	2.5	0	16
Males aged 15–65 years	2.0	1.7	0	10
Females aged 15–65 years	1.9	1.5	0	10
Age above 65 years	0.4	1.0	0	9
Males above 65 years	0.1	0.7	0	9
Females above 65 years	0.4	1.2	0	11
Total of literates	3.1	2.3	0	12
Male literates	1.6	1.7	0	11
Female literates	1.5	1.5	0	16
Total of employed	2.5	0.2	0	15
Total of unemployed	3.9	2.6	0	16

Source: Authors' field survey (2022)

ried, representing 86.71%, followed by those who were single (8.31%). This is an indication that the majority of the heads of households were married. It is also observed that most of the respondents (83.06%) were Muslims while a minority of the respondents (7.64%) were Christians. However, the respondents who were Traditionalists also make up 9.3% of the respondents. It is also evident from Table 4 that most of the respondents are engaged in forestry work (237 respondents), constituting 78.74% of the respondents (farmers, loggers and so on), and those who are salaried workers represent a minority of the respondents constituting 0.66% of the respondents.

The results from the factor analysis, as revealed in Table 5, show that the environmental impact has an eigenvalue of 1.08 and explains about 12% of the total variance. All the variables have a factor loading exceeding 0.5 which indicates that they are determining factors for the environmental impact of timber harvesting. The loss of biodiversity shows a greater impact of timber harvesting with a factor loading of 0.9. Figure 2 shows the laid down policy objectives of harvesting firms, the CSR.

Figure 2 shows the policy proposals that convinced the residents to allow harvesting firms to operate within the study area. The findings from the study area reveal that 17 respondents, representing 43% of the sample size, suggest that protecting the forest from illegal loggers was part of the objectives of the harvesting firms. Another policy objective is that for each tree cut down, there should be a tree planted as a replacement. Here, 21 of the respondents, which is 52.5%, confirmed that their respective firms agreed to replace any tree cut down. Two (2) respondents (5%) confirm tree planting projects as a policy to sustain the forest.

Figure 3 reveals the diverse forms of consultations with the harvesting firms prior to the policy agreements.

Figure 3 reveals consultations between the harvesting firms, the government of Sierra Leone and the residents within the study area. Twelve respondents (30%) indicate that the laid down policy objectives were based on policy consultations with other stakeholders, while eight respondents (20%) suggest that their CSR laid down policies were based on community sensitisations. Seven respondents (17.5%) con-

https://doi.org/10.17221/74/2023-JFS

Table 4. Demographic characteristics of the respondents

Demographic characteristics	Frequency	Percentage (%)
Sex		
Female	147	48.84
Male	154	51.16
Total	301	100.00
Level of education		
None	1	0.33
Basic	240	80.10
Secondary/high school	52	17.33
Tertiary	7	2.33
Total	300	100.00
Marital status		
Single	25	8.31
Married	261	86.71
Widowed	15	4.98
Total	301	100.00
Religion		
Christianity	23	7.64
Islam	250	83.06
Traditionalist	28	9.30
Total	301	100.00
Occupation		
Agriculture	9	2.99
Forestry	236	78.41
Petty trading	37	12.29
Craftmanship	13	4.32
Salaried worker	2	0.66
Other	4	1.33
Total	301	100.00
Gender head		
Female	160	53.16
Male	141	46.84
Total	301	100.00

Source: Authors' field survey (2022)

Table 5. Factor analysis of the environmental impact of timber harvesting

Factor and item	Factor loadings	Mean score	Eigenvalues	Variance (%)
Environmental impacts	–	–	1.08	0.12
Silting of rivers and lakes	0.7	4.3	–	–
Damaging trees and non-wood products	0.6	3.8	–	–
Loss of biodiversity	0.9	3.9	–	–
Loss of forest cover	0.6	4.1	–	–
Disappearance of vegetation	0.5	4.1	–	–
Climate change and global warming	0.6	4.1	–	–

Source: Authors' field survey (2022)

https://doi.org/10.17221/74/2023-JFS

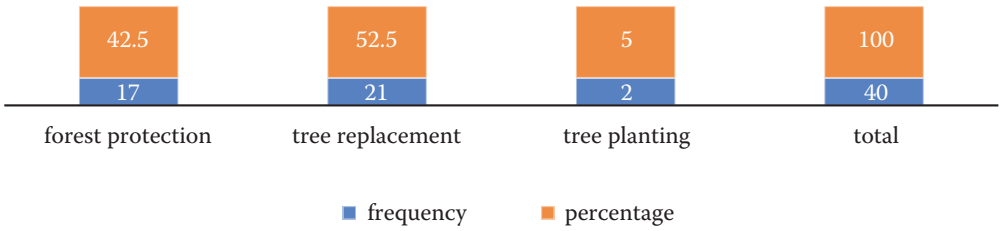

Figure 2. Laid-down policies of firms' Corporate Social Responsibilities (CSR)

Source: Authors' field survey (2022)

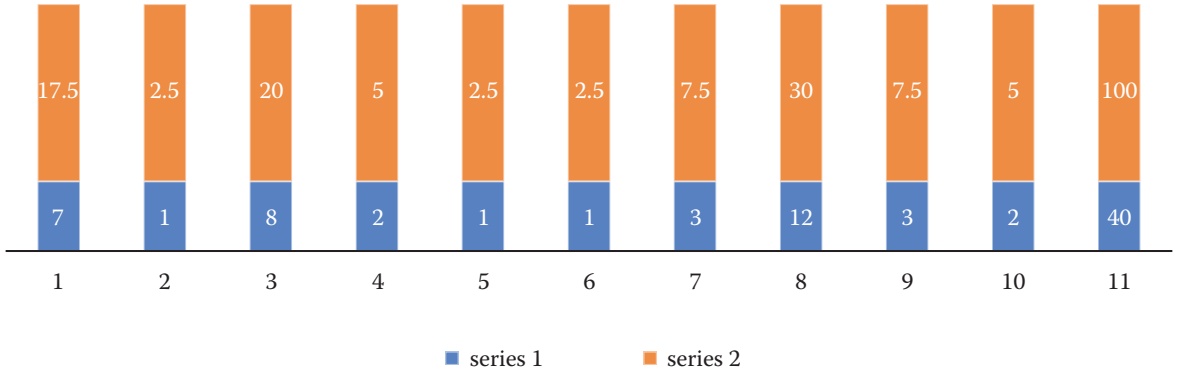

Figure 3. Firms' Corporate Social Responsibilities (CSR) policy formulation processes

1 – firms' specific CSR initiatives; 2 – management policies; 3 – community sensitisation; 4 – workers consultations; 5 – firms and government consultation corporations; 6 – community consultations; 7 – community sensitisations; 8 – policy consultation; 9 – stakeholder consultations; 10 – joint consultations; 11 – total number of respondents

Source: Authors' field survey (2022)

firmed that their policies were based on their own CSR-specific initiatives, as enshrined in their operational guidelines. Two, three, and another two respondents (representing 5%, 7.5%, and 5%, respectively) confirmed that their policies were based on worker consultations, stakeholder consultations, and joint consultations, respectively. One respondent claimed that CSR was formulated based on community consultation, one respondent claimed that CSR was based on management policies of the firm, and one respondent cited the combination of firms and government consultation resulted to CSRs. Figure 4 shows the prospective timeframe to implement the specific objectives of the firms' CSR.

Figure 4 shows an interesting result. It indicates the length of time to complete each CSR project ini-

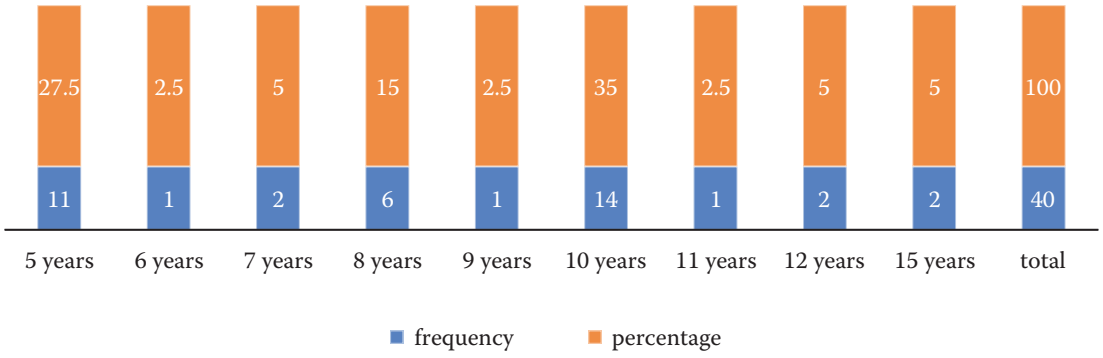

Figure 4. The life span of firms' Corporate Social Responsibilities (CSR)

Source: Authors' field survey (2022)

https://doi.org/10.17221/74/2023-JFS

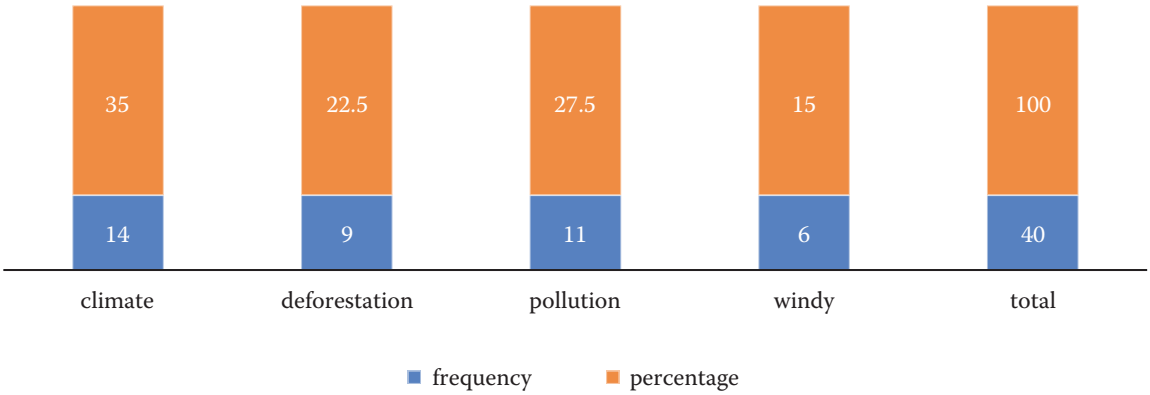

Figure 5. Environmental challenges and effects

Source: Authors' field survey (2022)

tiative, ranging from 5 years to 15 years. More firms (14 respondents representing 35% of the respondents) confirm that their CSR project implementation will last for 10 years, and only two respondents from each firm (5%), i.e. six respondents in total, indicated that their project implementations would last up to 15 years, 12 years, and 7 years. Two respondents each from three firms, representing 5% each, indicated the duration of their projects were 7 years, 12 years, and 15 years. Eleven respondents (27.5%) and six respondents (15%) suggested 5 and 8 years to complete their specific CSR objectives, respectively. Three firms have one respondent each, suggesting that their CSR completion periods were 6 years, 9 years, and 11 years, respectively.

The results for the environmental challenges encountered by the timber harvesting firms and other major players are presented in Figure 5.

The results from Figure 5 indicate that fourteen of the respondents, representing 35% of the harvesting firms, indicated that climate change is one of the effects from timber harvesting activities in the study area. Also, eleven and six respondents, representing 27.5% and 15% of the harvesting firms, cited pollution and stormy wind, respectively, as challenges associated with operating in the study area. A total of nine respondents each, representing 22.5% of the firms, indicated deforestation as a challenge associated with timber harvesting in the study area.

DISCUSSION

It can be deduced from the results that the environmental impact of timber harvesting is caused by the failure of firms to comply with their CSRs. Forest sustainability can be maintained if tree replacement, mitigation of illegal logging and other policy objectives of the harvesting firms are respected. Failure to fulfil the policy objectives of the harvesting firms resulted in climate change, pollution, deforestation, and excessive windy situations, as seen in Figure 5. Thus, the result supports the hypothesis that environmental impacts from timber harvesting are caused by neglecting forest sustainability principles. The results concur with similar conclusions of the relevant literature on the subject matter. The findings not only revealed violations of sustainable forest management principles but also identified the failure of timber harvesting firms to respect compliance with their core Corporate Social Responsibilities (CSRs) and timeframe.

The results from Table 3 suggest that more male children attend schools than their female counterparts, which supports the pattern in most African countries where male children have the advantage of attending schools over their female counterparts (Jackson et al. 2008). Furthermore, there is higher unemployment in the study area which supports the unemployment status of the country at a national level (Stats SL 2021). The result also reveals that typical individuals who engage in forestry jobs have an average age of 42.1, which corresponds to the rather youthful population of the country with 60% of the citizens below 45 years of age. The standard deviation (SD) at 12.7 seems high, but this is due to the high variance used in the analysis. However, when compared to the mean, it is relatively small. Table 3 also reveals that there is less variation in the age of the formal forestry workers, making the mean a reliable estimate of the respondents' age. These results are supported by Obasi et al. (2015), and Kamara and Su (2018).

https://doi.org/10.17221/74/2023-JFS

Table 4 reveals a male-dominated population, mostly younger than 65 years of age. This is a huge boost to the forestry work sector, given that the active male population was reduced by a proportion of 1 to 3 during the 11-year civil conflict in Sierra Leone (Namuene, Egbe 2022; Uzu et al. 2022). It is noted that there were more female heads of households than male, which could also be attributed to the fact that several households are headed by widows who lost their husbands during the civil crisis between 1991 and 2002. The lack of machines and equipment in the sector means that it relies on man power for the energy-intensive forestry jobs. This supports the result in Table 3 showing more households headed by females while much of the forestry work was performed by their male counterparts. It supports the complementary relationship between the social groups in the study area. Despite men being the traditional breadwinners of the family, female-headed households dominate the decision-making responsibilities. The educational level within the study area also suggests that the respondents were educated enough to understand the responses that they were providing and so can be trusted. These results agree with the findings of Munro and Horst (2012), and the Stats SL (2021).

In line with the Sierra Leone government's recent efforts to comply with binding international treaties, timber harvesting firms are required to hold consultations with relevant stakeholders to identify their core CSRs and how they intend to accomplish them within the stated timeframes. Most harvesting firms, farmer associations and NGOs (non-governmental organisations) operating in the study area demonstrated that reforestation and mitigating illegal logging are essential specific objectives of their firms. However, failure on the part of the harvesting firms reveals adverse environmental challenges such as climate change, pollution, deforestation, etc.

CONCLUSION

The paper sought to describe the role of timber harvesting firms in the environmental impact discussions and also presents the relevance of EU initiatives of the knowledge transfer in forest sustainability to Africa generally, and Sierra Leone specifically. Timber harvesting is a financially popular economic activity for firms and society, but it is also devastating for the environment if forestry management principles are ignored. It is evident from the results obtained that harvesting timber products unsustainably is a self-destructive route for any country. It will end up impoverishing the people, and, in most cases, violates treaties that the country is a signatory to. This conclusion aligns with the findings of Kamara and Su (2018) and Uzu et al. (2022) who opined that if timber harvesting is left uncontrolled, it will eventually lead to factors that will increase greenhouse gas (GHG) emissions. This conclusion also supports the findings of Sampson (2019) and Munro and Horst (2012), both of whom suggested that reforestation and mitigating illegal logging are crucial for forest sustainability.

It is prudent, therefore, to have an effective enforcement strategy at the local, national, and global levels to ensure that harvesting firms comply with their policy objectives as enshrined in their CSR documents. These are social contracts between the communities and the firms that must be executed. The fact that the environmental challenges in the study area, according to the results, are climate change, pollution, deforestation, and wind disturbances, which is confirmation of failure by the firms themselves and enough reason to hold them accountable. Moreover, the effective control by the government over the forests in Sierra Leone can mitigate the chances of civil conflicts. Scientific literature on timber products has concluded that forestry has been used as a tool for sponsoring armed conflicts in Africa, and this has not only claimed lives but has also reduced communities to the dangers of wind or catastrophic erosions (Maminiaina et al. 2020). Furthermore, exercising effective control over the forests will prevent the decline of government revenue and discourage rural-urban migration. From the foregoing conclusion, it is important to implement the following recommendations:

There is a need for a holistic approach to resource management and sustainability. This can include a further ban on commercial timber production for a specific period to allow revegetation and allow the government the much-needed time to reflect and subsequently fulfil the obligations of both the Kyoto Protocol and the Paris Treaty. It is also important that the government goes back to the policies of the 1990s and learns the good lessons therein. GHG emission levels were quite low and

https://doi.org/10.17221/74/2023-JFS

closer to the global compliance level, according to the World Resources Institute (2004).

Realising the consequence of timber harvesting from the CFA to be the silting of lakes, loss of biodiversity, damage to trees and non-wood products, and loss of forest cover and vegetation, it is recommended that both the government and the private sector intervene with a radical approach to mitigate such impacts.

REFERENCES

Agbo M., Rousselière D., Salanié J. (2015): Agricultural marketing cooperatives with direct selling: A cooperative-non-cooperative game. Journal of Economic Behavior and Organization, 109: 56–71.

Ajake A.O., Enang E.E. (2012): Demographic and socio-economic attributes affecting forest ecosystem exploitation and management in the rural communities of Cross River State, Nigeria. American International Journal of Contemporary Research, 2: 174–184.

Akomaning O.A., Darkwah S.A., Zivelova I. (2022): Sustainable management of Atiwa and forest reserves of Ghana towards rural development. Agricultural Science Research Journal, 12: 93–103.

Babbie E., Mouton J. (2010): The Practice of Social Research. 10th Ed. Cape Town, Oxford University Press Southern Africa: 674.

Bamwesigye D., Fialová J., Aldarhe M.M.A. (2021): European Union (EU) Management Practices in National Parks. In: Fialová J. (ed.): Public Recreation and Landscape Protection – With Sense Hand in Hand? Proceedings of the 12th Conference, Brno, May 10–11, 2021: 189–193.

Cerutti P.O., Sola P., Chenevoy A., Iiyama M., Yila J., Zhou W., Djoudi H., Atyi R.E., Gautier D.J., Gumbo D. et al. (2015): The socioeconomic and environmental impacts of wood energy value chains in Sub-Saharan Africa: A systematic map protocol. Environmental Evidence, 4: 1–7.

Chukwuone N.A., Okorji C.E. (2008): Willingness to pay for systematic management of community forests for conservation of non-timber forest products in Nigeria's rainforest region. In: Dellink R.B., Ruijs A. (eds): Economics of Poverty, Environment and Natural-Resource Use. Dordecht, Springer: 117–137.

Eckstein D., Künzel V., Schäfer L. (2018): Global Climate Risk Index 2018. Bonn, Germanwatch: 36. Available at: https://www.germanwatch.org/sites/default/files/publication/20432.pdf

FAO (2015): Global Forest Resources Assessment 2015: Country Report – Sierra Leone. Rome, FAO: 76. Available at: www.fao.org/3/az332e/az332e.pdf

Gianvenuti A., Vyamana V.G. (2018): Cost-benefit analysis of forestry interventions for supplying woodfuel in a refugee situation in the United Republic of Tanzania. Rome, Food and Agriculture Organization of the United Nations (FAO) and United Nations High Commissioner for Refugees (UNHCR): 44. Available at: https://www.fao.org/3/ca0164en/CA0164EN.pdf

Government of Sierra Leone (2021): National Statement. In: The 26th Conference of Parties of the UN Framework Conventions on Climate Change, Glasgow, Nov 1–2, 2021. Available at: https://unfccc.int/cop-26/speeches-and-statements#List-of-Speakers-for-the-Resumed-High-Level-Segmen

Grootaers J.L., Bortelot A. (2017): Visions from the Forest: The Art of Liberia and Sierra Leone. Minneapolis, Minneapolis Institute of Arts: 239.

Hirano S. (2003): United Nations sustainable development. United Nations conference on environment & development, Rio de Janerio, June 3–14, 1992: 351. Available at: https://sustainabledevelopment.un.org/content/documents/Agenda21.pdf

Howard J.L., McKeever D.B., Bilek E.M. (2016): Criterion 6 Indicator 28: Total and Per Capita Consumption of Wood and Wood Products in Roundwood Equivalents. Research Note FPL-RN-0338. Madison, Department of Agriculture, Forest Service, Forest Products Laboratory: 22.

Jackson R.R., Randerson J.T., Canadell J.G., Anderson R.G., Avissar R., Baldocchi D.D., Bonan G.B., Caldeira K., Diffenbaugh N.S., Field C.B., Hungate B.A., Jobbágy E.G., Kueppers L.M., Nosetto M.D., Pataki D.E. (2008): Protecting climate with forests. Environmental Research Letters, 3: 044006.

Kamara M.J., Su L. (2018): Sierra Leonean log export ban policy: Balancing sustainable forest management and the economy. International Journal of Science and Research, 9: 356–361.

Krejcie R.V., Morgan D.W. (1970): Determining sample size for research activities. Educational and Psychological Measurements, 30: 607–610.

Maminiaina R., Alade A., James P.M., Emurana S.N. (2020): Greater Gola Landscape. Initiative of the WAEMU and ECOWAS Commissions funded by the 11th European Development Fund for support to conservation landscapes in West Africa: 4. Available at: https://papfor.org/IMG/pdf/fact-sheet-gola_foya.pdf

Munro P., Horst G.H. (2012): The governance and trade of wood-based products in and around the Kambui Hills North Forest Reserve 2012. Available at: https://static1.squarespace.com/static/55b0533ce4b04e4467333254/t/567a3514b204d58613bdb7b4/1450849556791/knhfr_gov_%26_mnge.pdf (accessed Apr 10, 2023).

https://doi.org/10.17221/74/2023-JFS

Namuene K.S., Egbe A.E. (2022): Impact of timber logging on neighbouring stands in a forest of the southwestern Cameroon. Open Journal of Forestry, 12: 248–262.

Nduche M., Brehm J.M., Abberton M., Omosun G., Maxted N. (2020): West African crop wild relative checklist, prioritization and inventory. Genetic Resources, 2: 55–65.

Nermin H., Francesco C. (2022): Evidence emerging from the survey on European Union Timber Regulation [REG. (EU) 995/2010] in Italy. Open Journal of Forestry, 12: 142–161.

Obasi F.A., Agbo F.U., Onyenekwe C.S. (2015): Environmental and socio-economic effects of timber harvesting in Ebonyi State, Nigeria. African Journal of Agricultural Research, 10: 1233–1238.

Salmivaara A., Miettinen M., Finér L., Launiainen S., Korpunen H., Tuominen S., Heikkonen J., Nevalainen P., Sirén M., Ala-Ilomäki J., Uusitalo J. (2018): Wheel rut measurements by forest machine-mounted LiDAR sensors – Accuracy and potential for operational application? International Journal of Forest Engineering, 29: 41–52.

Sampson E.M., Udoh V., Sampson S.N.M., Abraham C. (2019): Environmental and socio-economic effects of timber exploitation in Imo River Estuary, Eastern Obolo, Akwa Ibom State, Nigeria. International Journal of Social Sciences and Economic Review, 1: 22–28.

Stats SL (2021): 2021 Mid-Term Population and Housing Census. Statistics Sierra Leone: 46. Available at: https://www.statistics.sl/images/StatisticsSL/Documents/Census/MTPHC_Preliminary_Report/Final_Preliminary_Report_2021_MTPHC.pdf

UN Department of Economic and Social Affairs (1992): Forest Principles – Report of the United Nations Conference on Environment and Development, Rio de Janeiro, June 3–14, 1992. Available at: https://bit.ly/32obt36 (accessed Apr 10, 2023).

Uzu J., Bettinger P., Siry J., Mei B. (2022): Timber business in West Africa: A review and outlook. International Forestry Review, 2: 240–256.

Wadsworth R.A, Lebbie A.R. (2019): What happened to the forests of Sierra Leone? Land, 8: 80.

World Bank (2020): Annual Report 2020. Washington, DC, The World Bank: 106. Available at: https://elibrary.worldbank.org/doi/epdf/10.1596/978-1-4648-1619-2

World Resources Institute (2004): WRI Annual Report 2004. Washington, DC, World Resources Institute: 48.

Zhang F., Johnson D.M., Wang J., Yu C. (2016): Cost, energy use and GHG emissions for forest biomass harvesting operations. Energy, 114: 1053–1062.

Received: June 30, 2023
Accepted: December 6, 2023