International Journal of Development and Sustainability
ISSN: 2186-8662 – www.isdsnet.com/ijds
Volume 4 Number 4 (2015): Pages 425-445
ISDS Article ID: IJDS14123001

Occupational safety and health problems in forest harvesting operations: Case of Wattle Company Nyanga Pine Estate, Zimbabwe

Mark Matsa *, Johannes Mandowa

Department of Geography and Environmental Studies, Midlands State University, Gweru, Zimbabwe

Abstract

The study evaluated occupational safety and health problems in forest harvesting operations at Wattle Company Nyanga Pine Estate. Questionnaires, interviews, and direct observations were employed to extract primary data from the respondents. Secondary data was acquired from the Estate's SHE department's records and the Nyanga Pine Estate clinic's 'injury on duty' records. Data analysis was conducted using statistical and descriptive methods. Results revealed being crushed by rolling logs and chest pains respectively as the most common safety and health problems in forest harvesting operations. Occupational accidents and health ailments were not significantly correlated to occupation. It also emerged from the study that the safety and health problems in forest harvesting operations are mainly caused by poor remuneration and non provision of personal protective equipment. 59.3% of the questionnaire respondents identified harvesting work as very unsafe and unhealthy. The interviewees' described harvesting work as dangerous. The study recommends that Nyanga Pine Estate management boost workers' morale through provision of better remuneration and adequate personal protective clothing and equipment. The Ministry of Labour and Social Welfare through NSSA should enact specific safety and health legislation that pays particular attention to forestry sector.

Keywords: Occupational safety; Nyanga Pine Estate; Forest harvesting; Wattle Company; Behaviour based Safety

* Corresponding author. *E-mail address:* matsam@msu.ac.zw, markmatsa3@gmail.com

1. Background to the study

Forestry work is generally characterized as heavy, dirty and dangerous work requiring unnatural and uncomfortable working postures and exposures to noise and vibration. In addition forestry workers often endure unfavorable living conditions with poor housing, infrastructure and hygiene compared with people living in cities (Marianne and Maarten, 2002). The risks are created as a direct result of forestry operations themselves, both those involved in logging and those in subsequent processing. Most risks are associated with uneven terrain, dense tree population, poor working conditions and climatic extremes (ILO, 2007).

In many countries around the world there has emerged discouraging trends such as a rise in rates of work-related accidents which, combined with a rise in occupational diseases, are responsible for the high rate of early retirement in the forest industry (Axelsson, 1997; Morat, 2001). The observation is more pronounced in developing countries which, because of poverty, often lack basic needs like descent housing and balanced food diets. (ILO, 1999). Comparative statistics from different countries have shown that the forestry industry has a higher frequency rate of work-related accidents than other sectors of industry (Poschen, 1993; Staal, 2001). Muchemedzi (2007) observed that the global workforce stands at 2, 8 billion with approximately 300 000 employed in the wood and wood products industry and globally 2, 2 million work-related fatalities and 270 million occupational injuries occur annually. The largest number of fatalities is associated with the timber industry with 92, 4 % deaths (Jerie, 2012).

Previously occupational diseases played only a minor role in forestry but the use of portable machines, mechanization and exposure to dangerous substances has changed this picture. Back pain resulting from physical heavy work and unfavorable working postures is very common among chainsaw operators. An extensive survey in German found that after ten years of work, one third to one half of workers complained of back pain. Among older workers up to two thirds were affected (Sabel, 1986). Chainsaws, power brush cutters and many skidders and loaders produce unacceptably too much noise than can be tolerated by the human ear. According to Tsioras (2012), chainsaws can demage the human ear within only 15 minutes of exposure.

A closer inspection of the accidents occurring in the forestry industry reveals that harvesting is far more hazardous than other forestry operation (ILO, 1991). Within forest harvesting, tree felling and cross cutting are the jobs with most accidents particularly serious or fatal ones. Forest harvesting with or without machinery is difficult especially on steep slopes and is connected to high accident risk (ILO, 1998). It has been reported that timber harvesting is responsible for 65-80 % of all the accidents in the forestry sector (Efthymiou, 2008). In Indonesia, for example, timber harvesting-related accidents contributed 9% to the total national fatal accidents record between 1995 and 1999, accounting for 232 deaths (ILO, 2002; Yovi, 2009).

It has been noted according to National Social Security Agency (NSSA) Annual Statistical report of 2011 that the Accident Prevention and Workers Compensation Scheme has been registering several occupational accidents and diseases from the forest harvesting operations on a yearly basis since 2001. The report reveals that out of the 26 fatalities recorded during the period 2001 to 2011, about 80, 7% of the fatalities had occurred within forest harvesting operations, the bulk of which (more than 50 %) having occurred at Wattle

Company Nyanga Pine Estate (NSSA, 2011). According to Mutetwa (2011), this sad trend has been exacerbated by a lack of specific legislation to enforce safety and health in the forestry sector. However, ILO (1991) noted that lack of basic accident regulations for forest safety and health is not only a problem in Zimbabwe but in most developing countries even those with flourishing logging industries.

Despite global efforts to improve occupational safety and health in the forestry industry, occupational injuries in forestry harvesting operations have generally remained inadmissibly high and a cause for great concern (FAO, 2009). There is now greater awareness and consensus than before in many countries that accident risks in forest harvesting operations require continuing attention (ILO, 1998).

Zimbabwe forestry workers are not an exception to the occupational safety and health problems facing forestry workers worldwide. Occupational accidents and related diseases have been a serious challenge for Zimbabwe in the past twenty years of economic and infrastructural de-capitalization. This has seriously affected the forestry sector. The average injury frequency rate for the forestry sector was noted as four for the period 2004 to 2009 thereby placing the forestry sector among the top ten unsafe and unhealthy occupations in Zimbabwe (Mutetwa and Dozva, 2013). According to On Guard magazine of April 2011, occupational fatalities involving forest workers in Zimbabwe have been occurring every year since 2001 with an average of two fatalities per year. The year 2012 saw another fatality being recorded in this sector and by October 2013, three fatalities involving forest harvesting workers had been recorded. Interestingly, a closer analysis of the fatalities recorded in the forestry sector since 2001 to date reveals that a total of 82 % of the fatalities occurred within forest harvesting operations with a majority 61% having occurred at Wattle Company Nyanga Pine Estate.

According to the NSSA Annual Statistical Report of 2011, there has been no research that has been conducted in Zimbabwe focusing particularly on unpacking occupational safety and health problems in forestry harvesting operations. This is despite the fact that fatal accidents occurring within the forest harvesting operations are indeed a source of great human suffering both physically and emotionally. The hazardous nature of forest harvesting operations has triggered a need to study safety and health problems facing forest harvesting workers at Wattle Company Nyanga Pine Estate.

2. Map and description of the study area

Wattle Company`s Nyanga Pine Estate (Figure 1) covers an area of 14 679 hectares and is located in the Manicaland province of Zimbabwe 60 kilometers north of Mutare and 50 kilometers south of Nyanga. The estate currently employs approximately 867 workers that include permanent workers, labourers on daily contracts and contracting companies. The Estate lies in the commercial farming land of Nyanga administrative ward number 26 (Sanyanga) between latitudes 18° 32` south and longitude 32° 44` east. The Estate is bordered to the south and west by communal farming land and to the north and east by Forest land and National Parks land.

The seasonality of rainfall follows the same general pattern as the rest of the country with the bulk of the rainfall being confined to the months of November to March inclusive. Most of the precipitation derives from the east. Small amounts of winter precipitation in the form of mist occur regularly on areas of high elevation. Temperatures on the estate are pleasantly moderate with the lowest temperatures being experienced from May to August and the highest from October to February. The prevailing wind is easterly which blows dominantly during the months of November to May. A northeasterly wind blows during the period of August to November generally meaning hot and dry periods when a low pressure has developed south of the country.

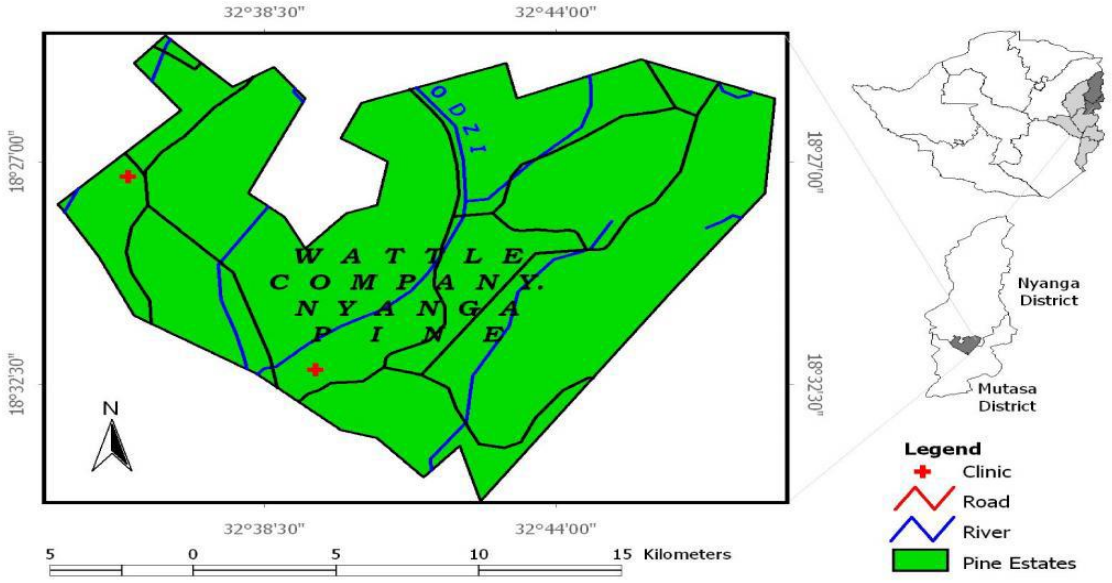

Figure 1. Map of Wattle Company Nyanga Pine Estate

The estate is underlain by the ancient craton of granite and gneiss known as the Basement complex which underlies much of Zimbabwe. The soils on the estate are classified according to the Zimbabwean system as orthoferrallitic within the Kaolinitic order, derived from either granite rocks or dolerite (Nyamapfeni, 1991). The estate is fully developed and has pine plantings largely restricted to *P. patula*, but include *P.taeda*, *P.elliottii,P. kesiya, P. tecunumanii and P Maximinoi.* The pine plantations are managed for sawmilling into timber and various board products that are sold on both the domestic and regional markets. Nyanga Pine estate is mainly drained in a northeast-southwest plane into Odzi River through the Nyakupinga and Nyamaropa rivers and into the Duru River which flows into Honde valley (Soper, 2000).

Currently the area accommodates approximately five thousand inhabitants with the majority of them unemployed and surviving on subsistence farming, livestock rearing and selling perishables in the form of fruits and vegetables at bus stops along the Mutare – Nyanga highway. The estate strengthened its good track record with neighbouring communities by allowing them to observe their cultural rituals like rain-making ceremonies at their traditional shrines. They also permit them to fetch thatching grass for domestic use.

3. Research methodology

The researchers utilized a descriptive survey research methodology to study occupational safety and health problems facing Wattle Company Nyanga Estate's forest harvesting employees. The descriptive survey methodology was chosen on the basis that it enabled the researchers to utilize several research instruments such as questionnaires, interviews, observations, documents and photographs to explore occupational safety and health problems in forest harvesting operations at Wattle Company Nyanga Pine Estate. Use of various research instruments was therefore critical as, it provided for data triangulation which is vital in allowing the researcher to be more confident about the validity of the findings when supported by multiple and complementary types of data (Polit and Hungler, 1999).

3.1. The study population

The target population in the research included a total of 59 forest harvesting workers made up of 14 tally clerks, 5 tractor drivers, 5 telle logger operators, 13 chainsaw operators, 1 urus operator, 7 log deck feeders, 3 skidder operators , 4 general workers, 6 harvesting supervisors and 1 harvesting manager. The selection of these workers was done taking cognizance of the fact that all forest harvesting employees bear the burden posed by occupational safety and health problems inherent in forest harvesting operations hence become key informants for this research. In addition, these employees who are involved in the forest harvesting processes were the main source of reliable information on various safety and health problems as they encounter them on a daily basis.

3.2. Sample and sampling procedure

A pre-survey that involved checking employment register for forest harvesting employees from the human resources department, interviewing the forest harvesting management and a field visit of the forest harvesting operations was done to ascertain the number of forest harvesting employees so as to draw an appropriate sample for the targeted population. Stratification was employed to divide the members of the target population (forest harvesting employees) into subgroups to ensure more representation of the population as depicted in Table 1.

The percentages were rounded off to the nearest whole number; hence the total percentage for the interview sample size does not add up to 100%. 69.5 % of the total number of workers directly involved in forest harvesting operations participated in the study. Taking cognizance of the small number of respondents, all the 14 tally clerks and 13 chainsaw operators representing 65.9 % of the sample size were selected for questionnaire administration. The questionnaire was self administered to allow employees to complete the questionnaires on their own without consultation thus avoiding biased responses (Trochim and William, 2006). A total of 12 respondents comprising of 2 tractor drivers, 2 telle logger operators, 2 log deck feeders, 2 skidder operators, 2 general hands and 2 harvesting supervisors were randomly selected for interviews. Random sampling was selected because it improves the representativeness of the sample by reducing sampling error (Hunt et al., 2001). The urus operator, being the only one in that occupation became an

automatic (purposive) candidate for interviews. The choice of interviews for the identified occupations was necessitated by the small number of workers per each occupation. Line managers in the form of forest harvesting supervisors were randomly selected for interviews because they were directly involved in controlling forest harvesting operations hence their inclusion allowed eliciting of in-depth information that augmented data gathered from the rest of the employees.

Table 1. Employee Distribution in Wattle Company Nyanga Pine Estate's Forest Harvesting Operations

Job Title	**Number of workers**		**Questionnaire Sample Size**		**Interviews Sample Size**	
	N	**%**	**N**	**%**	**N**	**%**
Tally clerk	14	24	14	52	0	0
Tractor Driver	5	8	0	0	2	14
Telle logger operator	5	8	0	0	2	14
Chainsaw operator	13	22	13	48	0	0
Urus operator	1	2	0	0	1	7
Log deck feeder	7	12	0	0	2	14
Skidder operator	3	5	0	0	2	14
General Hand	4	7	0	0	2	14
Harvesting Supervisor	6	10	0	0	2	14
Harvesting Manager	1	2	0	0	1	7
Total	**59**	**100**	**27**	**100**	**14**	**98**

Note: N denotes the number

Interviews were also extended to the forest harvesting manager, the SHE officer, Nurse in charge of Nyanga Estate clinic and a National Social Security Authority (NSSA)'s Occupational Safety and Health (OSH) Inspector. These other key informants were selected basing on the researchers' judgment. The harvesting manager being the overall in charge of the forest harvesting operation had the ultimate responsibility and accountability over occupational safety and health issues within forest harvesting operations hence his rich knowledge on occupational safety and health problems facing forest harvesting workers was important in

meeting the objectives of this study. Selection of a NSSA Inspector as an interviewee was necessitated by the fact that NSSA OSH Inspectorate department was the one mandated by the law to carry out safety and health inspections at workplaces and their experience in conducting accident investigation of work related accidents including those that occur within forest harvesting operations was valuable in mapping the way forward in addressing occupational safety and health problems in forest harvesting operations. The SHE officer and the nurse in charge were key informants for the interviews basing on their knowledge, skills and experience in dealing with various occupational accidents and diseases encountered by forest harvesting workers.

4. Results and discussion

A total of 27 questionnaires were sent out to the identified respondents for completion. All the 27 questionnaires were completed and returned for analysis, giving a response rate of 100 % (Figure 2).

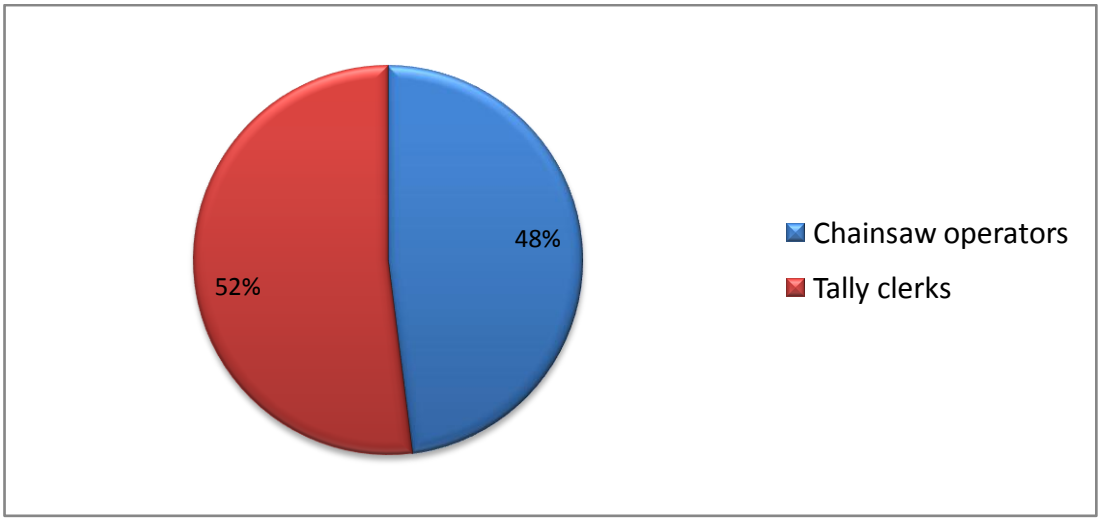

Figure 2. Questionnaire responses by percentage

All the identified interviewees' except the urus operator were interviewed. The urus operator could not be interviewed because the urus equipment was not in operation and the operator was on leave.

4.1. Socio-economic and demographic characteristics of the respondents

The majority of the respondents were men constituting 81.5 % of the total number of respondents and the remainder of 18.5 % were females from the tally clerk group. This observation of having more males than females in forest harvesting operations is consistent with an assertion by ILO (1999) that female employees tend to shun forestry work due to its physically heavy nature. A majority of the workers (33.3%) were within

the age group 31- 40 years. 88.9% of the respondents were married. Married people have greater social responsibility of looking after their families and as asserted by Lefort et al. (2003), occupational accidents and disease will have the effect of reducing their income thereby worsening their lifestyles.

Only 14.8% of the study population indicated that they were secondary school graduates and the rest of the respondents did not indicate their level of education. However human resources records revealed that harvesting employees were mostly primary and secondary school graduates. All the respondents indicated that they were permanent employees of Nyanga Pine Estate. While 88.9 % of the participants stated that their remuneration was very poor, 7.4 % qualified their remuneration as just poor. 3.7 % indicated that the remuneration was good. According to ILO (2001), poor remuneration has a psychological impact of causing stress amongst employees, ultimately leading to lack of concentration which eventually causes occupational accidents.

The group of respondents on the whole can be considered as experienced in their jobs, with 59.3% being in the category of 6-10 years work experience in forest harvesting and 44.4 % being in the same category in their current job. Kirk et al. (1997) noted that experience is a determinant factor to one's proneness to occupational accidents and diseases. The fact that the majority of employees had spent 6-10 years of their working time in forest harvesting operations portrayed an experienced workforce familiar with occupational safety and health hazards inherent in harvesting. On the other note, it was realized that some of the employees were highly exposed to occupational accidents due to limited experience.

The procedure to select and train machine operators is critical for occupational safety and health, and as such, it should be meticulously done (Garland, 1990). 88.8 % of the respondents indicated that they had received formal job training and 11.1% did not receive any form of training (Figure 3). Further analysis of the trainings reveals that all the chainsaw operators (100 %) had been trained. The untrained respondents were tally clerks. This revelation of having all chainsaw operators trained is in line with the guidelines of Forestry code of practice which require chainsaw operation to be conducted by certified chainsaw operators. FAO (1996) prescribe that all countries should have clearly defined minimum standards of skill for hazardous occupations including the forestry industry.

Though the percentage of respondents that received some form of training can be considered quite high given the hazardous nature of harvesting work, the realization that 11% of the respondents were engaged in forest harvesting activities without receiving any training is worrisome as these untrained individuals tend to be a barrier to improving safety and health standards in harvesting. According to Wettman (1992), inexperienced workers, with poor work techniques are generally given bigger workloads which expose them to back injuries.

4.2. Types of occupational safety problems encountered by the respondents

Types of occupational safety problems encountered by the respondents from the time they started working in forest harvesting operations were examined and the results are presented in Table 2.

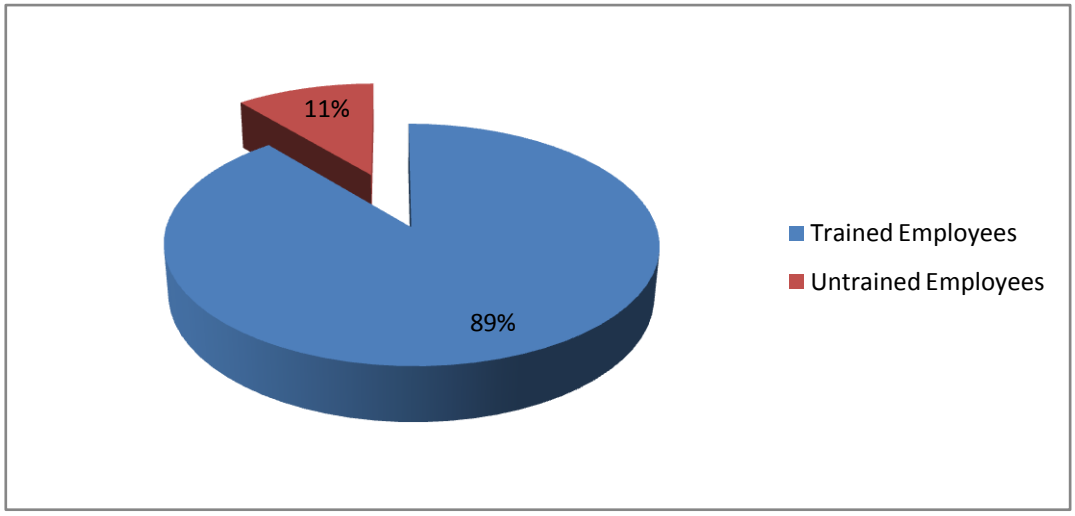

Figure 3. Percentages of trained and untrained forest harvesting employees

From Table 2, it was established that 59.3 % of the questionnaire respondents had experienced an accident during their occupational lives in forest harvesting. Telle logger operators and tractor drivers on being interviewed also confirmed having been involved in occupational accidents. The most frequently occurring types of accidents were: being crushed by rolling logs (25.9%), slips and falls (22.2%), pressed between logs (18.5%), cuts from machine (18.5%), hit by dead trees or branches (14.8%), and bites from bees (14.8%). Most of the interviewees confirmed that slips and falls were rampant during wet weather. More so there was a general consensus amongst the interviewees' that knocks (hits) by hung ups, dead trees or branches and chopped trees were responsible for fatal accidents involving forest harvesting workers especially the chainsaw operators. This assertion is in line with what was observed by Parmeggiani (1997) that hung up trees are frequent causes of severe and fatal accidents.

NSSA inspector of factories, in agreement with the deadly nature of tree felling process reiterated that in all his 23 years of experience as an inspector, he had never encountered a scenario where a forest employee survived after being hit by a chopped tree or a hung up tree. The hazard of being hit by dead trees or branches is worrisome considering that during the field observation, it was observed that some of the harvesting employees did not even have hard hats to protect their heads against the eventuality of being hit by dead branches. Despite forests being haven for snakes, it was noted from the respondents that none (0 %) had encountered an accident of being bitten by a snake. Clinic records also show that snake bites are not a common feature amongst forest harvesting employees.

4.3. Common types of occupational safety problems amongst forest harvesting workers

The study reveals that the most common type of accident amongst forest harvesting workers was that of being crushed by rolling logs which accounted for 85.2 %. Slips and falls at 81.5 % were also very common amongst forest harvesting workers. Other common types of accidents were hits by dead trees or branches (74.1%), pressed between logs (70.4%), hits by hung ups (70.4%), cuts from machines (74.1%) and bites

from bees (74.1%). Contrary to the revelation that bites from bees are common accidents amongst forest harvesting workers, the interviewees' (Harvesting Supervisors and the SHE officer) indicated that bites from bees were rare and only occurred when workers are working in areas where bee keeping is practiced.

Table 2. Distribution of occupational accidents encountered by the respondents

Parameter		**Occupation**					
		Chainsaw Operators		**Tally Clerk**		**Total**	
		N	**%**	**N**	**%**	**N**	**%**
Work accidents	**Yes**	10	76.9	6	42.9	16	59.3
	No	3	23.1	8	57.1	11	40.7
Type of accidents encountered	Crushed by rolling logs	5	38.5	2	14.3	7	25.9
	Slips and falls	3	23.1	3	21.4	6	22.2
	Hit by dead trees/branches	4	30.8	0	0	4	14.8
	Hit by chopped tree	1	7.7	0	0	1	3.7
	Pressed between logs	2	15.4	3	21.4	5	18.5
	Falling from mobile equipment	1	7.7	0	0	1	3.7
	Hit by hung ups	3	23.1	0	0	3	11.1
	Hit by mobile equipment	1	7.7	0	0	1	3.7
	Hit by snapping branches	2	15.4	1	7.1	3	11.1
	Cuts from machine	5	38.5	0	0	5	18.5
	Bites from snakes	0	0	0	0	0	0
	Bites from bees	2	15.4	2	14.3	4	14.8

Note: N - denotes number

It was observed from clinical records that most chainsaw operators are susceptible to cuts from machines especially when felling trees, debranching and when cross cutting. According to the Nurse-In-Charge of Nyanga Pine Estate clinic, these cuts are aggravated by lack of adequate personal protective equipment. Another common type of accident specific to mobile equipment operators according to interviewed telle logger operators and tractor drivers is overturning of the mobile equipment during extraction. Stellman (1998) also confirmed overturning of mobile equipment as a common hazard in extraction.

4.4. Statistical analysis to determine association between occupation of the respondent and type of accident encountered

Chi – square test was used to investigate whether the two factors (occupation and type of accidents) are independent or whether there is an association between them.

The formula for calculating chi-square test is stated below;

$$X^2 = \sum (O - E)^2 / E$$

where O is the Observed Frequency in each category, E is the Expected Frequency in the corresponding category, X^2 is Chi Square

H_0 -There is no association between occupation and type of an accident encountered.

H_1- There is an association between occupation and type of an accident encountered.

Chi-test X^2= 10.9187

Number of degrees of freedom (ν) = (no of rows -1) (number of columns -1)

= (12-1) (2-1)

= 11

The number of degrees of freedom ν is 11 and the $X^2(11)$ distribution is considered.

According to Hopkins (2002) an error margin of 5% is acceptable in Social Sciences and hence testing at 5% was considered in this research. From the statistical tables $X^2_{5\%}(11)$ is equal to 19.675. Since Chi test (X^2) is less than the Test statistic ($X^2_{5\%}(11)$), the null hypothesis (H_0) is accepted and the alternative hypothesis (H_1) is rejected. From the testing, it is concluded that at the 5% level the employee occupation has no association on the types of accidents encountered. The outcome therefore implies that occupational accidents affect all employees irrespective of occupation in forest harvesting operations.

4.5. Types of health problems suffered by the respondents

Table 3 indicates the types of occupational health ailments suffered by the respondents. A closer analysis of the results in Table 3 shows that the majority of the respondents (92.6%) at one time suffered from an occupational health ailment after they started to work in forestry. A paltry 7.4% indicated that they had

never suffered from an occupational health ailment. Most of the respondents indicated that they had suffered from more than one problem. Most commonly experienced ailments were back pain (63%), chest pain (59.3%), joint pain (33.3) and stress (29.6%). An intensive interview administered to the Estate's nurse-in-charge unearthed back pain as the most common health ailment affecting forest harvesting workers especially the chainsaw operators. In this study 61.5 % of the chainsaw operator confirmed having suffered from back pain. According to Sabel (1986), among chainsaw operators, musculoskeletal complains mainly affect the lower back because of physically heavy work in which unfavourable working positions often cannot be avoided.

Table 3. Distribution of occupational health ailments suffered by the respondents

Parameter		**Occupation**					
		Chainsaw Operators		**Tally Clerk**		**Total**	
		N	**%**	**N**	**%**	**N**	**%**
Occupational health ailment	**Yes**	11	84.6	14	100	25	92.6
	No	2	15.4	0	0	2	7.4
Type of Occupational Health ailment suffered	Hearing Impairment	3	23.1	3	21.4	6	22.2
	Back pain	8	61.5	9	64.3	17	63.0
	Chest pain	9	69.2	7	50	16	59.3
	Neck/ Shoulder pain	4	30.8	2	14.3	6	22.2
	White finger syndrome	5	38.5	1	7.1	6	22.2
	Repetitive strain injury	4	30.8	0	0	4	14.8
	Joint pain	5	38.5	4	28.6	9	33.3
	Stress	4	30.8	4	28.6	8	29.6
	Sprains	3	23.1	2	14.3	5	18.5
	Eyesight problem	3	23.1	0	0	3	11.1

In concurrence with the assertion by the respondents on the types of occupational health ailment they suffered, Acar and Senturk (1999), noted in a study carried out on the health of forestry workers that back

pains and rheumatism pains took centre stage in aching ailments. The SHE officer on being interviewed pointed out that occupational health ailments were difficult to diagnose since they took too long to manifest. However, he also stressed that hearing impairment was likely to be encountered by mobile equipment operators and chainsaw operators since they use equipment that produce excessive noise capable of inflicting damage to one's ear if the person is unprotected.

4.6. Common types of occupational health ailments amongst forest harvesting workers

There was consensus amongst the respondents that hearing impairment (77.8%), back pain (81.5%), chest pain (96.3%), stress (59.3%) and skin diseases (59.3%) were rampant amongst forest harvesting employees. Neck/Shoulder pain (22.2%) and eyesight problems (29.3%) were noted as very uncommon amongst forest harvesting employees. The nurse-in-charge of the clinic confirmed back pain and chest pain as problematic amongst forest harvesting employees. Interviewed mobile equipment operators such as tractor drivers, skidder operators and telle logger operators acknowledged hearing impairment, back pain and stress as most common health ailments amongst forest harvesting workers.

The nurse-in-charge further revealed that the rare cases of eyesight problems were encountered amongst mobile equipment operators and chainsaw operators who were in a habit of not putting on provided personal protective equipment as well as in certain circumstances where individuals would have reacted to pollen. White finger syndrome amongst the chainsaw operators is confirmed by a study that was carried out on several thousand forest workers in North Sweden that showed that 38% of all the chainsaw operators had 'white finger disease' (Stellman, 1998), a condition resulting from spastic constriction of the blood vessels in the hands that become more pronounced during cold weather (Parmeggiani, 1997). Observations conducted revealed that tasks for tally clerks and chainsaw operators involve a lot of bending, thereby making them susceptible to back injuries.

4.7. Statistical analysis to determine association between occupation of the respondents and type of occupational health ailment suffered

H_0 -There is no association between occupation and type of an occupational health ailment suffered.

H_1- There is an association between occupation and type of an occupational health ailment suffered.

Chi-test X^2= 8.07625

Number of degrees of freedom (ν) = (no of rows -1) (number of columns -1)

= (10-1) (2-1)

= 9

The number of degrees of freedom ν is 9 and the $X^2(9)$ distribution is considered.

From the statistical tables $X^2_{5\%}(9) = 16.919$

Since Chi test (X^2) is less than the Test statistic $X^2_{5\%}(9)$, the null hypothesis (H_0) is accepted and the alternative hypothesis (H_1) is rejected. At the 5% level a conclusion that the employee occupation has no

association with the type of occupational health ailments suffered by the respondents is drawn. This implies that occupational health ailments affect all forest harvesting employees irrespective of occupation.

4.8. Causes of occupational safety and health problems in forest harvesting operations

Table 4 shows the common causes of safety and health problems amongst forest harvesting employees. As noted from Table 4, the respondents were agreed on use of defective equipment (74.1%), non provision of personal protective equipment (77.8%), poor remuneration (92.6%), poor ergonomics (74.1%), excessive overtime (63%) and kickbacks from machine (63%) as most common causes of safety and health problems in forest harvesting. All interviewees lamented poor remuneration as a contributory factor to stress amongst forest harvesting employees. Poor remuneration is a psychological hazard capable of causing stress that takes away employees concentration thereby causing occupational accidents (Lefort et al., 2003).

Further probe into the issue of remuneration revealed that employees were not receiving their wages consistently due to viability challenges being encountered by the Estate and that had dampened their morale. Non provision of adequate personal protective equipment was also picked as a cause during field observations of forest harvesting operations. The researchers established during observations that some harvesting employees were wearing safety gloves that were worn out and no longer in a state to safeguard them against occupational hazards

NSSA factory inspector confirmed most of the common causes of safety and health problems in forest harvesting operations as alluded to by the questionnaire respondents but in contrast described poor remuneration as not a common cause. Instead, the NSSA factory Inspector described violation of work procedures when handling hung up trees as the frequent cause of severe and fatal accidents. Hung up trees are often termed 'widow makers' because of the high number of fatalities they cause (Poschen, 1993). Other causes of occupational safety and health problems in forest harvesting operations as observed by the researchers were unsafe acts practiced by the employees (Plates 1 and 2), poor housekeeping at the log deck, steep terrain that become more dangerous in wet weather and lack of consistence in conducting refresher safety and health training programmes.

In view of the unsafe acts observed by the researchers, the SHE officer indicated that the Nyanga Pine Estate SHE department had introduced a Behaviour Based Safety (BBS) programme code named 'Zvandaona Nyamusi' in 2009 as an intervention tool to arrest 'at risk' behaviour. The intention of the programme was to target correction of 'at risk' behaviour in line with what was postulated by Heinrick (1931) that unsafe behaviours account for 88% of occupational accidents at workplaces (NSSA, 2003).

The BBS programme was designed to take away fear amongst employees and provide a good platform for employees to influence each other on safe and healthy behaviours. However, the SHE officer acknowledged limited success scored by the BBS programme from its inception due to lack of top management support and involvement from the onset, hence the manifestation of unsafe acts in forest harvesting operations.

As shown on Plate 2, the two employees were observed within the telle logger equipment's danger zone, thereby exposing themselves to the danger of being hit by the logs in the likely event of them slipping from

the telle logger's grip. From the interviews conducted, it also emerged that most of telle logger accidents were caused by tree stumps and scattered logs at the log deck (Plate 3).

Table 4. Common causes of occupational safety and health problems amongst forest harvesting workers

Parameter		**Occupation**					
		Chainsaw Operators		**Tally Clerk**		**Total**	
		N	**%**	**N**	**%**	**N**	**%**
Common causes of safety and health problems amongst forest harvesting workers	Use of faulty/defective equipment	10	76.9	10	71.4	20	74.1
	Drunkenness	6	46.2	6	42.9	12	44.4
	Kickbacks from machine	10	76.9	7	50	17	63.0
	Non provision of Personal protective equipment	11	84.6	10	71.4	21	77.8
	Violation of work procedure	6	46.2	2	14.3	8	29.6
	Unrealistic targets	9	69.2	4	28.6	13	48.1
	Incompetent supervision	3	23.1	1	7.1	4	14.8
	Unfavourable weather conditions	7	53.8	3	21.4	10	37.0
	Poor remuneration	11	84.6	14	100	25	92.6
	Exhaust fumes	1	7.7	2	14.3	3	11.1
	Poor ergonomics	8	61.5	12	85.7	20	74.1
	Noise	7	53.8	5	35.7	12	44.4
	Vibration from machine	7	53.8	6	42.9	13	48.1
	Excessive overtime	9	69.2	8	57.1	17	63.0
	Lack of training	7	53.8	6	42.9	13	48.1
	Working during night	5	38.5	4	28.6	9	33.3

4.9. Ways to improve the overall safety and health situation of forest harvesting operations

59.3% of the respondents were of the opinion that forest harvesting work was very unsafe and unhealthy, while 40.7 % felt it was unsafe and unhealthy. Forest harvesting work was described by most of the interviewed individuals as dangerous implying that the majority were aware of the potential danger associated with forest harvesting operations and of the safety and health aspects of their jobs. This popular notion that forest harvesting work is dangerous is in tandem with an argument by ILO (1991) that forestry work is a "3- D" job: dirty, difficult and dangerous. Most of the respondents made more than one suggestion for improvements in the safety and health situation in forest harvesting.

Plate 1. An unsafe act of a telle logger operator trying to pull a defective tractor (Source: Field work)

Plate 2. An unsafe behaviour of employees watching within the telle logger equipment's danger zone (Source: Fieldwork)

The areas of improvement identified most frequently related to the need for improvement in the provision of safety gear (88.9%) and the need for improvement in employees' remuneration (81.5%). The need to pay wages timeously also featured highly amongst the respondents. The nurse-in-charge described the need for adequate personal protective clothing or equipment and remuneration that comes on time as necessary in the fight against forest harvesting accidents and diseases. Enhancement of safety training programmes (77.8%) was cited as the third most important area of improvement required. Many respondents also felt that pressure of work and shift length contributed to safety and health problems in forest harvesting, hence the reduction of pressure of work and shift length (77.8) were imperative. Mobile equipment operators were of the view that a paradigm shift starting from top management was required in curtailing use of faulty or defective equipment.

One harvesting supervisor felt that issues of productivity and income generation at the Estate were taking centre stage at the expense of most basic safety and health issues and recommended the need for a more serious approach to be spearheaded by top management. The SHE officer and the NSSA inspector concurred on the need to ensure that forest work is legislated. According to NSSA (2011), Zimbabwe is yet to come up with a piece of legislation that deals specifically with occupational safety and health problems in the forestry sector. Chingofa (2010) acknowledged that the legislative gap in forestry safety and health was creating serious challenges in combating forestry occupational accidents and diseases.

Plate 3. Tree stump that cause telle logger equipment overturning accidents (Source: Fieldwork)

5. Conclusion

Basing on the results of the study, forest harvesting work has proved to be a haven for an array of adverse safety and health problems and as such has the potential of threatening lives of employees involved in harvesting work not only at Wattle Company Nyanga Pine Estate but in the forestry sector at large. Further, it can be drawn from the results that forest harvesting work is a dangerous occupation. Outstanding safety and health problems associated with harvesting work that emerged from the study include being crushed by rolling logs (85.2 %), slips and falls (81.5 %), hits by dead trees or branches(74.1%), pressed between logs (70.4%), hit by hung ups (70.4%), cuts from machine (74.1%), hearing impairment (77.8%), back pain (81.5%), chest pain (96.3%), and stress (59.3%). It is evident from the research findings that in forest harvesting operations men are more prone to occupational accidents and diseases than females.

It has also emerged from the study that the safety and health problems realized in forest harvesting operations are mainly caused by use of defective equipment (74.1%), non provision of personal protective equipment (77.8%), poor remuneration (92.6%), poor ergonomics (74.1%), excessive overtime (63%) and kickbacks from machine (63%). The research also highlight that in order to mitigate the identified causes of occupational safety and health problems in forestry harvesting operation, it is important for the Government

of Zimbabwe through the Ministry of Labour and Social Welfare to consider enacting safety and health laws that incorporate forestry work. In addition other areas of improvement identified by the research as requiring urgent attention include provision of safety gear (88.9%), improvement in employees' remuneration (81.5%) and enhancement of safety training programmes (77.8%).

It came out from the study that the Estate SHE department's endeavor to address 'at risk behaviour' amongst employees through a behaviour based safety (BBS) programme code named 'Zvandaona Nyamusi' was not yielding good results mainly due to an acute shortage of resources and lack of full management involvement from the onset. The Estate's management underscored that the principal challenge in addressing causes of safety and health challenges in forest harvesting operations rests on the estate's weaker financial base largely attributed to viability problems in timber business.

6. Recommendations

Basing on the research's outcome that forest harvesting operation is associated with a host of occupational safety and health challenges, the research proposes a set of recommendations as follows:

Top management of Wattle Company Nyanga Pine Estate should support the Behaviour Based Safety programme 'Zvandaona Nyamusi' initiative as an intervention tool for accident and ill health prevention because of its ability to target and correct 'at risk' behaviours that are known to account for largest number (88%) of occupational accidents and diseases at workplaces. Wattle Company Nyanga Pine Estate's management should commit itself to providing adequate resources to address challenges of erratic personal protective clothing or equipment as well as to improve forest harvesting employees' welfare (poor remuneration) so as to reduce stress that contribute to occupational accidents and ill health. Ministry of Labour and Social Welfare, through NSSA should strengthen enforcement mechanisms by enacting safety and health legislation that specifically addresses forestry safety and health problems. NSSA should augment accident and ill-health prevention efforts by Wattle Company Nyanga Pine Estate's SHE department by conducting regular inspection of forest harvesting work to expose and correct unsafe acts and conditions timeously taking cognizance of the hazardous nature of forest harvesting. Back pain and chest pain emerged as real health challenges amongst forest harvesting workers. It is therefore paramount that Wattle Company Nyanga Pine Estate engages the services of NSSA's ergonomist to carry out a comprehensive ergonomic survey to unearth ergonomic hazards that are responsible for most musculoskeletal problems suffered by the workers, the information of which is vital in coming up with effective preventive strategies. To avert problems of pressure of work and shift length, forest harvesting management should utilize a participatory approach where employees are allowed to have a say on how work targets are devised. This will allow the crafting of realistic targets thereby curtailing unsafe behaviours such as taking shortcuts that are usually prompted by unachievable targets.

References

Acar, H. and Senturk, N. (1999), "Research on Occupational Health Workers in Artvin Forest Region", *J. Instanbul Univ. For. Fac.*, Vol. 49 No. 1, pp. 25.

Axelsson, S. (1997), Forestry, In: Brune, D(ed), *The workplace,* Vol. 2 part 7,2, International Labour office, Geneva and Scandinavian Science Publisher, Oslo, pp. 728-749.

Chingofa, B. (2010), "Health and Safety Laws in Zimbabwe", http//www.mywage.org/Zimbabwe .Accessed 21 March 2012.

Efthymiou, P. (2008), *Wood Harvesting*, Aristotle University of Thessaloniki, Thessaloniki, Greece.

FAO (Food and Agricultural Organisation) (1996), *Model Code of Forest Harvesting Practice*, FAO Publications, Rome.

FAO (Food and Agricultural Organisation) (2009), *State of the World's Forest*, FAO Publications, Rome.

Garland, J. (1990), Machine Operator Selection and Training, Timber Harvesting and Extension Specialist, Forest Engineering Department, Oregon State University, Unpublished Article.

ILO (International Labour Organization)(2001), Conditions of work and life in the timber industry, Report 11, Second Tripartite Technical Meeting for the Timber Industry, International Labour Office, Geneva.

ILO (1991), *The future of the forestry workforce in Geneva Report*, Forestry and Wood Industries Committee, Geneva.

ILO (1998), *Safety and health in forestry work*, ILO codes of practice. International Labour Office, Geneva.

ILO (1999), Forestry, wood, pulp and paper. International Labour Office, Geneva, Switzerland, http://www.ilo.org/public/English/dialogue/sector/sectors/forest.htm.updated 15 July 1999.

ILO (2007), *Approaches to labour inspection in forestry,* International Labour Office, Geneva.

Jerie, S. (2012), "Occupational health and safety problems among workers in the wood processing industries in Mutare", *Journal of Emerging Trends in Economics and Management Sciences,* Vol. 3 No. 3, pp. 278-285.

Lefort, A.J., Lefort Jr, A.J., de Hoop, C.F., Pine, J.C ., and Marx, B.D. (2003), "Characteristics of Injuries in the Logging Industry of Louisiana, USA: 1986 to 1998", *Internatinal. Journal of Forest Engineering*, Vol. 14, pp. 75-89.

Marianne, L. and Maarten, N. (2002), "Health and safety issues and perceptions of forest harvesting contractors in Ireland", *International Journal of Forest Engineering*, Vol. 13 No. 2.

Muchemedzi , S. (2007), "Violations of OSH responsibilities and legal liabilities", *On Guard an Aid to Occupational Safety and Health*, Vol. 12 No. 1, pp. 13.

Mutetwa, B., and Dozva, R. (2013), "A Critical Analysis of Accident Causes in the Basic Metal Production and Metal Fabrication Industries in Zimbabwe", *On Guard, An Aid to Occupational Safety and Health*, Vol. 19. No.1, pp. 6-8.

Mutetwa, B. (2011), "Occupational Hygiene and Hazard Prevention", *On Guard Magazine*, Vol. 17 No. 1, pp. 1-5

NSSA (National Social Security Authority) (2003), *Train the Trainer Manual*. 1st Edition, Division of Occupational Safety and Health, Zimbabwe.

NSSA (National Social Security Authority) (2011), *Annual Statistical Report, Occupational Injuries and Pensions and Other Benefits Statistics*, Celsys Print, Harare.

NSSA (National Social Security Authority) (2013), *Workers Compensation registry's half yearly accident statistics,* NSSA, Harare.

Nyamapfeni, K. (1991), *Soils in Zimbabwe*, Nehanda Publishing House, Harare.

Parmeggiani, L. (1997), *Encyclopaedia of Occupational Health and Safety*, 3rd Edition, Vol. 1, ILO, Geneva.

Polit, D. and Hungler, B. (1999), *Nursing Research: Principles and Methods* (6th edn), J.B. Lippincott, Philadelphia.

Poschen, P. (1993), *Forestry a Safe and Healthy Profession*?, Unasylva 172.Vol. 44, pp.3-12.

Sabel, I. (1986), "Occupational health services for workers in the state forest of Baden-Würtemberg", *Proceedings: Seminar on Occupational Health and Rehabilitation of Forest Workers, Kuopio, Finland, 3-7 June 1985*, Helsinki, Finnish Government Printing Press.

Soper, R. (2000), *The agricultural landscape of the Nyanga area of Zimbabwe*, New York.

Staal , D. (2001), *Heat Stress in forestry work*, Doctoral diss. Dept. of Silviculture, University of Agricultural Sciences, Silvestria.

Stellman, C. (1998), *Encyclopaedia of Occupational Health and Safety*, 4th Edition, Vol 3, ILO, Geneva.

Trochim, William K. (2006), Research Methods Knowledge Base, http://www.socialresearchmethods.net /kb/index.php (Accessed 7 March, 2006).

Tsioras, A. (2012), *Promotion of Safety in Forest Operations*, Department of Harvesting and Technology of Forest Products. Aristotle University of Thessaloniki, Thessaloniki, Greece. www.arsa-conf.com/archive.

Wettman, O. (1992), "Securite au travail dans l'exploitation forestiere en Suisse", In *FAO/ECE/ILO Proceedings of Seminar on the Future of the Forestry Work force,* edited by FAO/ECE/ILO, Corvallis, Oregon State University Press.

Yovi, E. (2009), "Assessing OSH protection on forestry work through competency approach", *The Indonesian Journal of Physiology,* Vol. 8 No. 2, pp:94-100.