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Human-caused effect on tree health and growth condition of five commercial trees in the savanna wood lands, Tamale-Ghana

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Abstract

This research assessed the extent of human activities which cause injuries and wounds to trees and their effects on the growth of five commercial trees in the savanna wood lands (Tamale metropolis). The study was conducted in six (6) suburbs within two sub metros; Tamale Central (Aboabo, Zogbeli and Sabonjida) and Tamale South (Lamashegu, Vittin and Kalpohini) in the Tamale metropolitan in the Northern region of Ghana. Descriptive social survey was designed to portray accurate profile of persons, events and situations. A triangular methodology comprising of questionnaire, interview and observation technique was employed in gathering the needed data. For basic data collection, systematic random sampling was used to select sample of 376 respondents from the six suburbs in the metropolis. There was general assertion that state authorities and residents do not protect the trees especially those in the principal streets of the metropolis. This affected their growth led to the death of many. Educating residents and critically regulating the activities of advertising companies in the metropolis may significantly reduce injuries and wounds of trees.

Keywords: Tree injuries, Khaya senegalensis, Azadiracta indica, Acacia Senegal, Adonsonia digitata, Parkia biglobosa, Ghana.

1. Introduction

The importance of woody plants in the ecosystem cannot be overemphasized. Trees are not only used for timber purposes but play an important role in restoring, reclaiming and rejuvenating deputed soils. Their ecological and environmental uses, educational and recreational value as well as their historical and aesthetical uses are vital to human lives [1]. Trees have been vital for the people of Ghana. For instance, majority of the populace still depend upon firewood as fuel for cooking resulting in deforestation. The sub-Sahara and savanna zones are adversely affected by this problem. Furthermore, human consumption and the constant peeling of the bark of trees for medicinal purposes have induced savannization of sub-Sahara Africa [2]. It is reported that, human activities have transformed much of the sub-Saharan tropical forests into landscapes. Timber harvesting, firewood collection, illegal tree felling and uncontrolled bush burning are some of the activities which led to the drastic reduction of the Ghanaian forest [3]. Deforestation has also led to increase soil erosion and loss of reliable water supply decrease in agricultural production leading to low standard of living [3]. Harvesting trees for firewood, fencing backyard garden, and medicinal purposes is common in developing countries [2] and Tamale metropolis in the northern region of Ghana is no exception. Some commercial trees are consistently wounded and injured due to constant harvesting as well as the rapid development of the metropolis. Most peasant farmers are forced convert their farmlands into backyard gardens and as such require fencing against animal destruction. Planting trees is good and necessary for existence and support of human lives. However, due to indiscriminate harvesting of trees because of the increasing demand for local and herbal medicines, there is massive and visible degradation of planted and wild trees in the metropolis. In fact, these activities have led to the death of many trees due to exposure to hard weather conditions. This has lead to associated hardships such as poor rainfall pattern, destruction of properties by wind, outbreak of diseases, and desertification. The Tamale metropolis lies within the savannah woodland zone. The trees in this zone are

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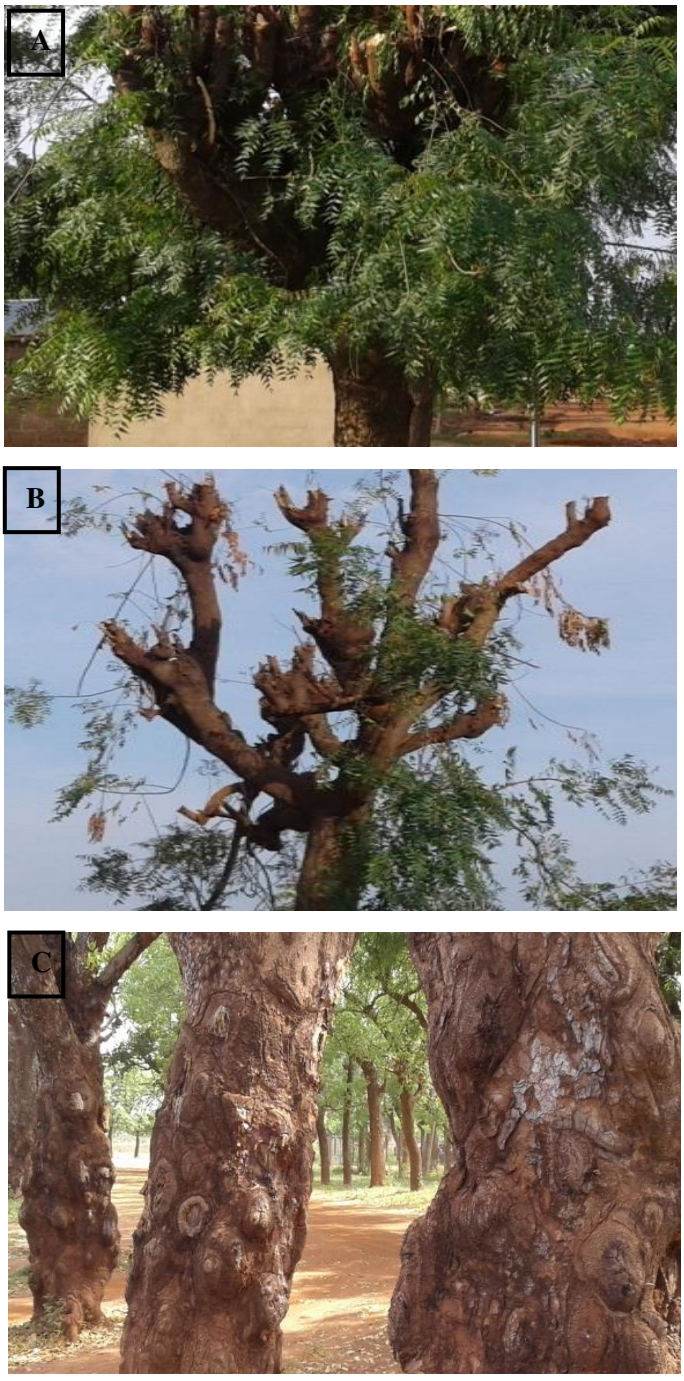
short scattered wood lots in nature. The major trees studied were *Parkia biglobosa* (dawadawa), *Azadirachta indica* (nim), *Acacia Senegal* (acacia), *Khaya senegalensis* (African mahogany) or (kuntunkuri), and *Adansonia digitata* (baobab). These tree species were selected for the study because of their dominance and their economic value to the people of the metropolis. *P. biglobosa* (dawadawa) is a perennial deciduous tree that belongs to the family *Fabaceal*. The tree is distinguished by its thick dark brown-grayish bark and bears hanging pods that measures approximately 30 to 45cm long with each pod containing close to 30 seeds. The seeds are commonly known as locus beans that tend to be pinkish in colour on their early stages but changes to dark brown on full maturity [4]. The reported economic importance of *P. biglobosa* includes; the stem bark is used in treating wounds, burns, ulcers, and high blood pressure. The leaves are used as an antidiarrheal agent and the seeds are used in making popular dawadawa seasonings and substitute for coffee. *K. senegalensis* (mahogany) is the least popular among the African mahogany group of species belonging to the family *Meliaceae*. The tree grows to about 35m high and 3m in girth. It has a dense crown and short bole, covered with a dark-gray scaly bark. The slash is dark-pink and yields gum. The leaves are pinnate with 3 to 4 pairs of leaflets; 5 - 10cm long and 2.5-5 cm broad, more or less elliptic and obtuse. The flowers have pale-green sepals and cream petals with a staminal tube occasionally appear from January to April. Each fruit is about 6cm long and 2.5mm thick, matures from December to April. The seeds and leaves are used to treat fever and headache while the root extract is used to treat mental illness, leprosy, and syphilis [5]. *A. indica* (nim) is a tropical evergreen tree native to India. It grows well in Ghana, mostly in the Tamale metropolis. It is known as the 'village pharmacy' because of its healing versatility and medicinal properties. The seeds bark and leaves contain compounds with proven antiseptic, antiviral, antipyretic, anti-inflammatory, anti-ulcer and antifungal uses [4]. Nim has a garlic-like odour and a bitter taste. *A. Senegal*, (acacia) from the family *Fabaaceae*, native to tropical and subtropical regions of the world, particularly Australia and Africa, where they are well known landmarks on the veld and savanna. Its distinctive leaves take the form of small finely divided leaflets that give the leafstalk a feathery appearance. They are also distinguished by their small often fragrant flowers which are arranged in compact cylindrical clusters. The flowers are usually yellow but occasionally white and have many stamens giving it a fuzzy appearance. This species are economically important as the bark is very rich in tannin, which is used in tanning and in dyes, inks, pharmaceuticals and other products [4]. *A. digitata* (baobab), the majestic baobab tree is an icon of the African continent and lies at the heart of many traditional African remedies and folklore. It grows in 32 African countries and can live for up to 5,000 years; grow up to 30 metres high and up to an enormous 50 metres in girth. The tree provides shelter, food and in some cases water for animals and humans. The bark can be tuned into rope and clothing, the seeds can be used to make cosmetic oils, the leaves are edible, and the fruit pulp is extraordinarily rich in nutrients [4]. Due to these economic importance and uses, the populace mostly harvests the branch, stem bark and the roots as shown in Fig. 1 which affect the health and growth of the studied species that leads to their eventual death. The objective of the study was to investigate human activities that cause most wounds and injuries to trees in the Tamale metropolis. This is intendant to create the awareness among the citizenry the importance of these trees and the need to protect them in the metropolis for national development.



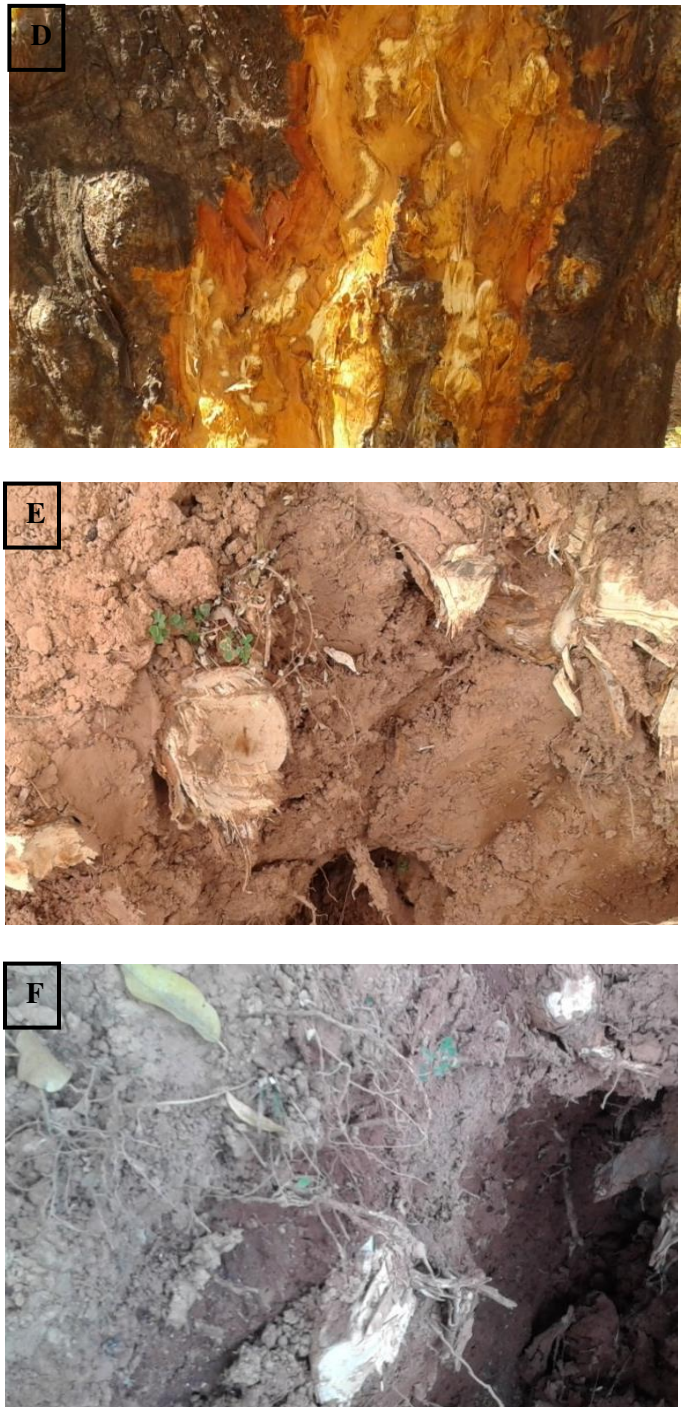


Figure 1: Some injuries of branches (A and B), Stem (C and D) and Root (E and F).

1.1 Definition of terms

An injury is an impairment or loss of function. Wound is a type of injury characterized by a physical disruption of living tissues. Fire scar is a wound caused by fire and involves the disruption and death of some portion of the vascular cambium. Compartmentalization is the limit-setting process that resists the loss of normal wood function and the spread of microbial infection after wounding. Wound closure is the process of restoring the circumferential continuity of the vascular cambium [6].

2. Methodology

2.1 Study Area

The Tamale Metropolis is one of the 26 districts in the Northern Region. It is located in the central part of the Region shares boundaries with the Sagnarigu District to the West and North, Mion District to the East, East Gonja to the South and Central Gonja to the South-West. The metropolis has a total estimated land size of 646.90180 square kilometer [7]. Geographically, the metropolis lies between latitude 9º 16 and 9º 34 North and longitudes 0º 36 and 0º 57 west. The metropolis is 180 meters above sea level and the land is undulating with a few isolated hills. It has a single rainfall season starting from May - October in a year, characterized by harmattan winds from November – February with a minimum and maximum temperature 25^0C and 40^0C [7].

2.2 Research Design and Data Collection

The study used descriptive social survey design to portray accurate profile of persons, events and situations as well as describe the distribution of phenomena in the sample [8]; [9]. The survey design is usually associated with deductive research approach [10]. Surveys of this nature provide effective way of describing the characteristics of a population [9]. A triangulation technique comprising of the use of questionnaires, interviews and observations (photography) were employed to gather data from respondents.

For data collection, systematic random sampling was used to select sample of three hundred and seventy-six (376) respondents from the six suburbs within the metropolis. Personal interviews (34) and participant observation were conducted to confirm the information generated from the questionnaire. Scenes of the study were captured to strengthen evidence of observed events. The data obtained were evaluated using content analysis, descriptive statistics and graphs. Most of the five commercial trees identified were examined on how their harvest for; fodder, firewood, fencing and herbs affected their growth. Respondents were assured of confidentiality and that responses and information provided would be used solely for academic purposes.

3. Results and Discussion

3.1 Results

Table 1: report results obtained from the study. The four major uses of the living tree parts that cause wounds to living trees sampled from the metropolis are fodder, firewood, fencing and

herbs. The highest reason for tree injury reported by the respondents was herbs which recorded a total of 2761 (36.72%) responses while fencing was the second highest with 1724 (22.93%) responses. The third reason why most species are injured in the metropolis is using some tree parts as firewood with a total of 1065 (14.16%) responses. And fodder was the least reason why respondents injured living trees. It recorded a total of 92 (1.22%) responses.

Table 1: Results from respondents about the major causes of tree injury in the Tamale Metropolis.

Species	Parts	Fodder	Firewood	Fencing	Herbs
	B	21 (5.59%)	143 (38.03%)	154 (40.96%)	58 (15.42%)
Khaya senegalensis	S	7 (1.86%)	24 (6.38%)	38 (10.11%)	307 (81.65%)
	R	0 (0 %)	16 (4.25%)	1 (0.27%)	359 (95.48%)
	T	**28 (2.48%)**	**183 (16.22%)**	**193 (17.12%)**	**724 (64.18%)**
	B	5 (1.33%)	87 (23.14%)	156 (41.49%)	128 (34.04%)
Azadiracta indica	S	0 (0%)	159 (42.29%)	183 (48.67%)	38 (9.04%)
	R	0 (0%)	59 (15.69%)	0 (0%)	317 (84.31%)
	T	**5 (0.44%)**	**305 (26.94%)**	**339 (29.95%)**	**483 (42.67%)**
	B	56 (14.89%)	33 (8.78%)	86 (22.87%)	201 (53.46%)
Acacia senegal	S	2 (0.53%)	47 (12.50%)	289 (76.86%)	38 (10.11%)
	R	0 (0%)	28 (7.45%)	241 (64.09%)	107 (28.46%)
	T	**58 (5.14%)**	**108 (9.57%)**	**616 (54.62%)**	**346 (30.67%)**
	B	0 (0%)	5 (1.33%)	78 (20.74%)	293 (77.93%)
Adansonia digitata	S	0 (0%)	3 (0.79%)	184 (48.94%)	189 (50.27%)
	R	0 (0%)	2 (0.53%)	0 (0%)	374 (99.47%)
	T	**0 (0%)**	**10 (0.88%)**	**262 (23.23%)**	**856 (75.89%)**
	B	1 (0.27%)	250 (66.49%)	120 (31.91%)	5 (1.33%)
Parkia biglobosa	S	0 (0%)	173 (46.01%)	186 (49.47%)	17 (4.52%)
	R	0 (0%)	38 (10.10%)	8 (2.13%)	330 (87.77%)
	T	**1 (0.08%)**	**461 (40.87%)**	**314 (27.84%)**	**352 (31.21%)**

Note~ B=branch, S=stem, R=root and T=total usage

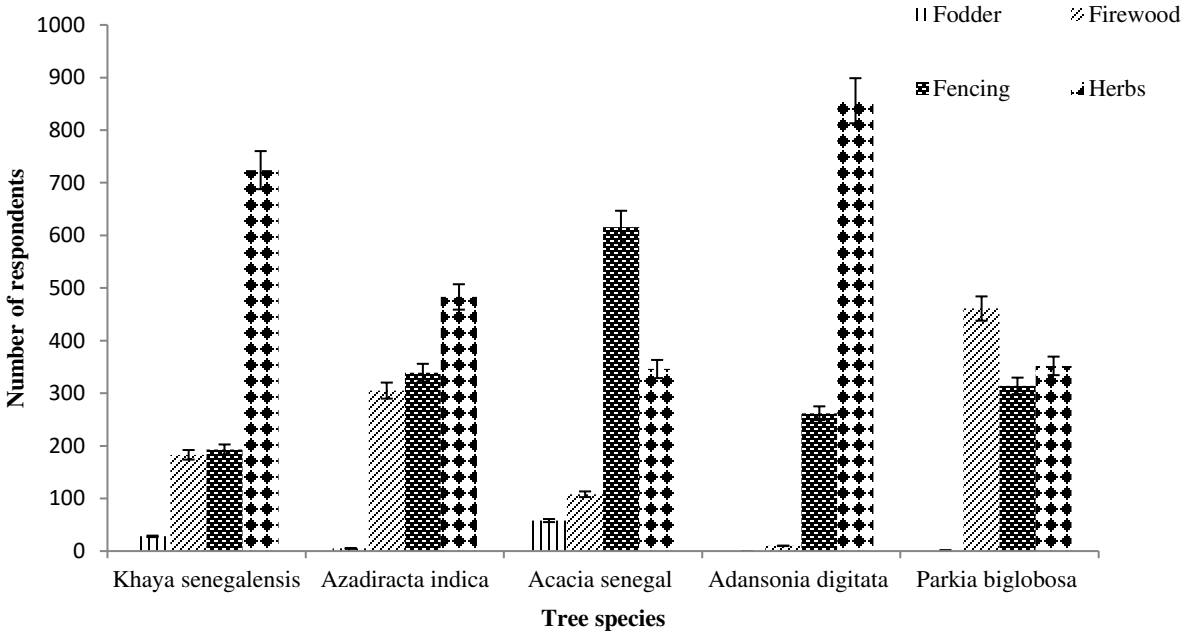


Figure 2: The four major causes of tree injury of species studied

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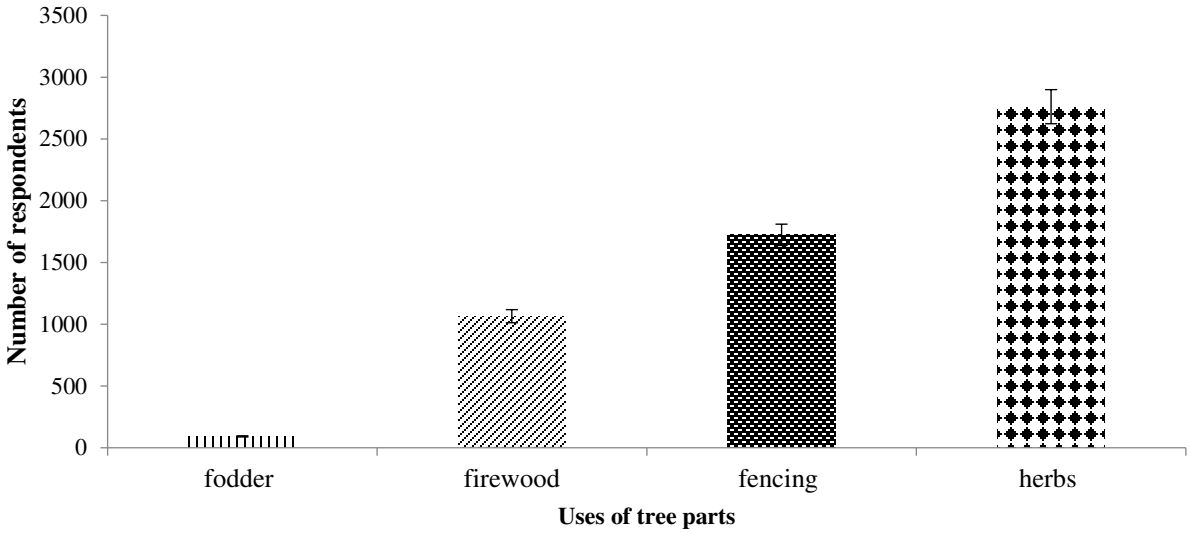

Figure 3: *Level of severity of the cause of tree injury*

3.2 Discussions

The used of wood parts for medicinal purpose was the highest human activity that cause injury and wounds to trees as shown in the study. This is due to the frequent harvest of all the tree parts for herbs which is more likely to be the associated to the use of traditional medicine by the populace in the study area. Fencing was considered the next highest activity that causes injury and wounds to the trees. This is due to the fact that farming is one of the major activities among the populace as majority of them cut the branches of the tree to fence their backyard farms to prevent them from animal destruction.

Moreover the use of firewood as an alternative source of fuel also resulted to the injury and wounds of the trees under studied. This implies that about half of the populace is more likely to use firewood instead of liquefied petroleum gas and electricity due to their inability to afford. It follows that, the cause of tree injury and wounds due to harvesting of tree parts for animal feed seemed to have very little effect on the trees growth.

This low incidence of fodder as human activity that causes injury and wounds to the trees was not surprising given the fact that animals in the study area have other alternative feed such as cereals, grass and more importantly the animals are mostly on free range feeding. It was also observed that, the human activities that cause injury and wounds to the trees were continuous. Root and the bole wounds always become infected, and the decay progresses more rapidly affecting the tree growth than the branch wounds. A large wound increases the likelihood of infection by decay fungi and increases the amount of decay than small wounds. Nevertheless, the closer a wound to the ground the more likely it is to become infected and the more severe the infection. However, wounds in which the sapwood is gouged and splintered are more likely to be infected and have more decay than wounds that remove only the bark. As such, [11], reported that, rough surface wounds takes longer period for new wood to grow over it.

4. Conclusions

Harvesting tree parts for firewood, fencing garden, feeding animals and for local medicine among the people of the Tamale metropolis in the northern region of Ghana has caused massive degradation of some tree species in the metropolis. This paper aimed at creating the awareness for minimizing injuries and wounds caused to trees due to human activities in the metropolis. The study showed that the frequent reason why respondents harvest tree parts is for use as herbs, followed by fencing, firewood and then fodder. The habit of nailing, and screwing advertisements banners as well as metal plates and posters also contributed to trees injury within the metropolis. Most of the tree species studied were characterized by physical disruption and distortion of their root, stem and branch tissues. Also, as a result of burning of refuse under trees the vascular cambium of most of them are dead.

Interestingly, two (2) of the species studied (*K. senegalensis*, and *A. digitata*) were observed to have rapid wound closure development abilities in restoring the circumferential continuity of their vascular cambium. Respondents agreed that human activities cause injury and wounds to the studied trees. There was also the general assertion that state authorities assigned the responsibility of protecting the environment were not doing enough to protect the trees in the metropolis. Educating residents and critically regulating the activities of advertising companies in the metropolis may significantly reduce the injuries and wounds caused to the trees.

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