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Mechanized Infantry Training Exercise as a Threat to the Vegetation Resources in the Savanna Ecological Zone, Nigeria

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Abstract
Infantry training exercises are conducted on terrestrial ecosystem which harbour a lot of natural resources on which the local inhabitants depend for their livelihood. A mechanized infantry training exercise in Kaduna State, Nigeria, was used to assess the impact of these trainings on the natural resources of the ecosystem. Plants and other forms of vegetation damaged by troops were collected. Also, plants that were uprooted or damaged along the trench lines or by moving armoured personnel carriers and military trucks were identified. These damaged plants were put in different use categories. Result revealed that a total of 1813 plants spread in fifty-seven species were uprooted or severed from the main tree during the training. Fifteen (26.3%) damaged species served as food to the indigenous people and animals in the ecosystem. These include *Annona senegalensis and Piliostigma thonningii*. Ten (0.6%) species are used for soup and spices. They include *Brachystegia eurycoma and Afzelia africana*. *Ficus sur and Afzelia africana* were among the seventeen plants that served as forage and fodder species. The people depend on twenty (35.09%) of damaged plant species for their health care and harvest eight plant species for sale, construction and provision of house hold items. The training impacted negatively on the wild plant resources on which the people and wildlife depend on for their sustenance. There is need to integrate the suitability of any chosen training arena with the potential loss of natural resources that might come to the local people through collateral damage on the biota.
Keywords: Damage, Exercise, Infantry, Resources, Vegetation

1.0 INTRODUCTION

Natural vegetation is a store house of abundant and readily available natural resources for rural people and at no cost. A recent World Bank report revealed that 90% of the 66% of Nigerian, who live below poverty level, reside in rural areas and depend on resources generated from the forest for their livelihood (World Bank, 2001). Okali (2004) in a similar observation reported that food harvested from the savanna vegetation constitute about 70% of the dietary intake of rural people. Consequently, wild food plants are critical sources of food particularly for the poor (Jodha, 1991). They are also important buffer during certain seasons (De waal, 1989) or major periods of stress (Grumbo*et al*., 1990). For instance, famine food in West Africa includes roots, rhizomes, tuber, barks, buds, leaves, fruits and seeds (Irvine, 1952). Of the above the most widely consumed part of the vegetation are the leaves which are used in stew, soup and relishes, (Isichei, 2005). Their advantages over domesticated food crop include high protein, vitamins and mineral content. Also their seeds and nuts have high calorific value and are robust and free of any indigestible component (Mande, 2005). Isichie (2005) reported that less than 20% of all known plant species in the world produce the world food.

In addition to their nutritional services, local plants are good pharmaceuticals with over 80% of rural people depending on plants for their health care delivery (Isichei, 2005). It has been reported that about 25% of prescription drugs are derived from wild plants (Ischei, 2005). Presently, Nigeria has about 4614 identified plant species and about three hundred of these plants species are known to have medicinal values (Adjanahoun*et al*., 1993) while less than 20% of all know plant species in the world, produce the world food (Isichei, 2005).

Unfortunately, these few useful food plants are under serious threat as evidenced from disappearing habitats and growing tally of extinction. The main forces causing the extinction of wild plants are deforestation, desertification, agriculture and grazing. Military training exercises play a major but often neglected role in the depletion of non-wood forest resources. This is because infantry training exercises are conducted on terrestrial ecosystem and often result in extensive damage to the vegetation. The damage comes through deliberate digging of trenches for cover, decapitation of leafy shoot for camouflage, bombardment of vegetation with artillery, mortar and other explosive devices. Also movement of heavy duty trucks and armoured personnel carriers inflict extensive damage to the vegetation. Clearing of the land for the erection of tent accommodation for officers also leads to extensive loss of vegetation. The frequency of the exercises and the damage caused are often so severe that recovery from past disturbance is compromised (Quist *et al*., 2003). A compositional shift in the plant community and invasion by new species which are alien to the people and which may displace the indigenous species that are sources of food and medicine to the rural people have been observed in vegetation subjected to military training operation (Quist *et al*., 2003).

It was in recognition of this threat that the 1972 Stockholm declaration stated that man has a responsibility to protect and preserve his environment for future generations. The UN charter was specific when it stated that nature should be secured against degradation and the military activities that are damaging to the vegetation

should be avoided (Principal 5 and 20). Consequently, member states of the United Nations formally rejected military activities which can cause damage to the natural environment (Westing, 1996). It is imperative therefore that man's activities must compliment the environment which is a storehouse of readily available food resources for the local people (Odiete, 1999). If these useful plants are destroyed, then our food security is under threat. Okojie (1993) defined food security as assess to food by all people at all times to enough food for an active healthy life. Isichei (2005) similarly has lent his voice when he submitted that food security depends on food availability and access to it.

In Nigeria, nobody has considered the damage done to our vegetation during military training operations as promoting food insecurity and as a potential threat to poverty alleviation in our rural communities. The objective of this research is to show that military training operation though essential for combat readiness is a potential threat to poverty alleviation in rural areas. Also the study highlights the need to consider the natural resource base of the environment where military training exercises are conducted.

2.0 METHODS

2.1 The study area

The Nigerian army has a permanent military training ground in Kachia, Kaduna State, Nigeria. It covers an area of about 24.9 km^2 and lies between latitude 9˚52´N and 9˚54´N, and longitude 7˚55´E and 7˚58´Eand is sitting on an elevation of 732 metres above sea level. The topography is undulating with several inselbergs dotting the landscape (Salawu, 1999). The vegetation is typical Guinea savanna (Salawu, 1999) and there is a conspicuous absence of anthropogenic activities like agricultural and urbanization within the training area.

2.2 Sampling Procedure

A recent mechanized infantry battle inoculation exercise in Kachia military training site was used for the study. All leafy plants shoots and other forms of the vegetation used by troops for different purpose like camouflage and other plants cleared from places where tents were erected were collected. Also plants that were completely uprooted or removed leafy shoot along the trench lines were assembled, enumerated and identified. Plants that suffered severe damage from moving armoured personnel carriers and military trucks were also collected, identified and documented.

Plant identification was done in the field according to Hutchinson and Dalziel (1954-1977) and Keay (1989). Unidentified plants and plants whose identification was doubtful were collected pressed in a plant press and taken to the laboratory at Nigerian Defence Academy, Kaduna for proper identification. The plant species were separated into their different use categories. Information on the uses of the damaged plant species to the rural poor was obtained from two sources namely primary and secondary. Primary sources refer to the administration of questionnaire on the local population after indicating the English and local names of each species beside it. This was supported by oral interview with farmers, herders and other inhabitants of the area. Secondary sources were obtained from relevant ethnobotanical literature (Akinsoji, 2003; Isichei, 2005; Osemeobo and Ujor, 1999).

2.3 Statistical analysis

Descriptive and analytical statistics such as mean, frequency and percentages were then used to calculate the loss suffered by each use category during the training exercise using the formula:

$$\frac{Noofdamagedplantsineachusecategory}{Totalplantsdamageduringtheexercise} \times 100$$

3.0 RESULT

3.1 Species composition and frequency

A total of one thousand eight hundred and thirteen plants either whole plants or shoots of plants that were either completely uprooted, or severed from the main tree during the training exercise were enumerated (Table 1). These were spread in twenty-six families, forty-nine genera and fifty-seven species. *Brachystegia eurycoma* was the most damaged species with the loss of fifty-four shoots, equivalent to 2.98% of the total damage followed by *Parkia biglobosa* with fifty-two shoots or 2.87%. The genus *Acacia* and family *Caesalpiniodae* were the most severely damaged genus and family with losses of one hundred and fifty-eight (8.71%) and two hundred and ninety-three (16.16%) respectively. Other identified damaged species include *Ximenia americana, Detarium microcarpum, Azadiraceta indica, Burkea africana, Ficus sur* among others. The damaged plant species are the wild resources that make enormous contributions to the needs of the local people and their economy as sources of food, fodder, medicine etc.

Table 1: Species composition of damaged plants during the training exercise

NAME OF PLANT	FREQUENCY	FAMILY
Acacia macrostachya -Reichenbe Ex Benth	41 2.26%	*Mimosoideae*
Acacia gourmaesis -A. Chev	28 1.54%	*Mimosoideae*
Acacia hockii –De Wild-L	19 1.05%	*Mimosoideae*
Acacia senegal (Linn) Wild	31 0.71%	*Mimosoideae*
Acacia seyal- Del-L	39 2.15%	*Mimosoideae*
Afzeliaafricana SM	21 1.19%	*Fabaceae*
Andropogongayanus (Linn)	28 1.54%	*Poaceae*
Anacardiumoccidentale (Linn)	43 2.37%	*Anacardiaceae*
Annona senegalensisPers	35 1.93%	*Annonaceae*
Brachystegiaeurycoma	54 2.98%	*Caesalpininoides*
Brideliaferruginea- Benth	39 2.15%	*Euphorbiaceae*
Burkea Africana	33 1.82%	*Caesalpininoides*
Butryrospermumparkii	33 1.82%	*Combretaceae*
Ceibapentandra	7 0.39%	*Bombacaceae*
CombretumnigricansGuill and Perr	47 2.59%	*Rubiaceae*
Crossopteryxfebrifuga-(Afza ex q. don)	21 1.16%	*Caesalpinoideae*
Danielliaoliveri-(rolfe) Hutch &Dalz-l	21 1.16%	*Caesalpinioides*
Detariummicrocarpum Harms	48 2.65%	*Caesalpinioideae*
Dialliumguineensis Wild	24 1.32%	*Leguminosae*
Eucalyptus camaldulensis Dehwn	33	*Myrtaceae*

	1.82%	
Eucalyptus cloeziana F. Muell-Blakely	27 0.15%	*Myrtaceae*
Elaeisguineensis	49 2.70%	*Arecaceae*
FicussurForssk	12 0.66%	*Moraceae*
GmelinaarboreaRoxb	43 2.37%	*Verbenaceae*
Hymenocardiaacida	27 1.49%	*Euphorbiaceae*
Hyparrheniarufa	49 2.70%	*Poaceae*
IsoberlinadokaCraibstapf	12 0.66%	*Caesalpinioideae*
Isoberlinatomentosa	28 1.54%	*Caesalpinioideae*
Khayasenegalensis-(desr) A.juss	36 1.99%	*Meliaceae*
Lanneaacida (A.Rich) (olive)Engl- Gillett Kew and Bull	42 2.32%	*Dipterocarpaceae*
Lophiralanceolata	18 0.99%	*Ochnaceae*
Milletiathonningii (Schum&Thonn)	24 1.32%	*Papilionoideae*
Mangiferaindica (Linn)	42 2.32%	*Anacardiaceae*
Maranthespolyandra – (Benth) Prance	21 1.16%	*Chrysobalanaceae*
Mitragynainermis	22 1.21%	*Rubiaceae*
MonoteskerstingiiGilg	27 1.49%	*Dipterocarpaceae*
MorusmesozygiaStapf	19 1.05%	*Moraceae*
Parkiabiglobosa (Jacq) R.Br ex G-Don	52 2.87%	*Mimosoideae*
Pennisetumpedicellatum	8 0.44%	*Poaceae*
Pinuscaribaea	36	*Pinaceae*

	1.99%	
Imperatacylindrica	9 0.49%	*Poaceae*
Piliostigmathonningii- (Schum) melne-redhead-l	33 1.82%	*Caesaepinioideae*
Prosopisafricana- (Guill& Per) Taub	18 0.99%	*Sterculiaceae*
Psidiumguajava Linn	47 2.59%	*Myrtaceae*
Tectona grandis Linn. F	43 2.37%	*Verbanaceae*
Termarindusindica (Linn)	43 2.37%	*Caesalpinioideae*
Terminalia mollis Laws	26 1.43%	*Combretaceae*
Terminalia glaucescens – Plach.exBenth	18 0.99%	*Combretaceae*
Terminalia macroptera – Guill& Per	25 1.38%	*Combretaceae*
Vernoniaamygdalina	39 2.15%	*Asteraceae*
Vitexdoniana	49 2.7%	*Verbenaceae*
Vitellariaparadoxa	43 2.37%	*Sapotaceae*
Ximeniaamericana- Linn	51 2.81%	*Olacaceae*
Ziziphusmauritiania Lam	7 0.39%	*Rubiaceae*

3.2 Food

Table 2 is a list of fifteen plant species or 26.3% of the damaged species which serve as food to the indigenous people in the community. Some of these species include *Anonnasenegalensis, Tamarindus indica, Piliostigma thonningii, Ximenia americana, Vitex doniana* and *Detarium macrocarpium.* Three of these species, *Ximenia americana, Vitex doniana* and *Detarium macrocarpium* suffered the highest damage in this use category with losses of 51, 49 and 48 shoots respectively, equivalent to 8.78%, 8.43% and 8.26% respectively. The most utilized parts by humans and wild life are the fruits, seeds and leaves. The cumulative shoot loss in this use category is five hundred and eighty-one (32.05%).

Table 2: Damaged plant species used as food

NAME OF PLANT	FAMILY	UTILIZATION	PART USED	CONSUMED BY	ECOLOGICAL STATUS
Adansonia digitata	*Bombacaceae*	Food	Leaves and Fruit	Eaten by man and animal	Moderate
Anacardium occidentale	*Anacardiaceae*	Food	Fruit and seed	Fruits and seeds eaten by man	Scarce
Annona senegalensis	*Annonaceae*	Food	Fruit	Natural fruits are eaten by both man and primate	Moderate
Butryospermum parkii	*Combretaceae*	Food	Fruit	Fruits are eaten by man and birds	Scarce
Mangifera indica	*Anacardiaceae*	Food	Fruit	Fruits are eaten by man and bats	Abundant
Psidium guajava	*Myrtaceae*	Food	Fruit	Fruits are eaten by man and birds	Abundant
Tamarindus indica	*Caesalpinideae*	Food	Fruit	Fruits are eaten by man	Moderate
Ficus sur	*Moraceae*	Food	Fruit/leaves	Fruits are eaten by man and birds	Moderate
Vitellaria paradoxa	Sapotaceae	Food	Fruit	Fruits are eaten by man	Abundant
Vitex doniana	*Verbanaceae*	Food	Fruit/leaves	Wild animals and man eat their fruits	Moderate
Piliostigma thonningii	*Caesalpinideae*	Food	Seed	Seeds are eaten by wild animals	Abundant
Lannea acida	Dipterocarpaceae	Food	Fruit	Birds feed on the fruits	Moderate
Detarium microcarpum	*Caesalpinideae*	Food	Fruit	Fruits are eaten by man and primates	Moderate
Terminalia glaucescens	*Combretaceae*	Food	Leaves	Leaves eaten by bush buck and duiker	Moderate
Ximenia americana	*Olacaceae*	Food	Fruit	Eaten by both man and animals	Moderate

Ecological status source: Osemeobo (1999) and Isichei (2005).

3.3 Soup and Spices

The local people also harvest ten plant species or 0.6% of the damaged species for preparing their soup and also as spices and seasoners, at no cost (Table 3). The preferred parts of the plants are the leaf which serves as vegetable while the seeds and nuts are used as additives and thickeners of soup and stew. These species occurred in eight families and include *Brachystegiaeurycoma, Afzeliaafricana* which are used as thickeners, *Adansoniadigitata, Ficuscapensis*and *Vitexdoniana*which are vegetable added to soup and stew. The species used as spices and seasoners in this pack include *Parkiabiglobosa* and *Prosopsisafricana*. The total number of damaged shoot in this use group was three hundred and seventy-nine (20.90%) with two species. *Brychystegiaeurycoma*and *parkiabigglobosa* contributing 27.99% to the damaged shoot (Table 3).

Table 3: Damaged plant species used for soup and as spices

NAME OF PLANT	FAMILY	UTILIZATION	PART USED	USES	ECOLOGICAL STATUS
Brachystegia eurycoma	*Caesalpiniodeae*	Soup	Seed	Seeds are used as food condiment	Moderate
Adansonia digitata	*Bombacaceae*	Soup	Leaves	Young leaves are used as vegetable by locals	Moderate
Afzeliaafricana	*Caesalpiniodeae*	Soup	Seed	Seeds are grounded and used to thicken soup	Moderate
Ficuscapensis(sur)	*Moraceae*	Soup	Leaves	Fresh leaves are used to make soup	Moderate
Parkiabiglobosa	*Mimosoideae*	Soup	Seed	Used in soup as spices for seasoning cooking	Moderate
Prosopsisafricana	*Sterculaceae*	Stew	Seed	Used as spices in cooking	Depleting
Vitexdoniana	*Verbanaceae*	Soup	Vegetable	Leaves are used for cooking soup	Moderate
Elaeisguineensis	*Arecarceae*	Soup	Nut	Palm oil used widely in cooking	Moderate
Vernoniaamygdalina	*Asteraceae*	Soup	Leaves	leaves used in soup and stew preparation	Moderate
Termarindusindica	*Caesalpiniodeae*	Soup	Seed	Seeds are used in preparing soup by locals	Moderate

3.4 Forage and Fodder Species

Table 4 gives the plants used as forage and fodder species. Seventeen species were identified in this use category. Some species here are *Ficussur, Afzeliaafricana, Khayasenegalensis, Tamarindusindica and Parkiabiglobosa*. They are fed on by the wildlife and cattle in the ecosystem and the local people also collect them fresh, dry them and use them to feed their domestic animals during periods of stress or drought.These fodder/forage species lost five hundred and forty-two shoots to the training exercise, equivalent to 29.9% of the total loss.

Table 4: Damaged plant species in the training area used as livestock feed/fodder

NAME OF PLANT	FAMILY	USES	PART USED	PREPARATION	ECOLOGICAL STATUS
Acacia senegal.	*Mimosoideae.*	Fodder	Leaves	Drying	Moderate
Adansoniadigitata	*Bombacaceae*	Fodder	Leaves	Drying	Moderate
Afzeliaafricana	*Caesalpininoides*	Fodder	Leaves	Drying	Scarce
Anogeissusleiocarpa	*Combretaceae*	Fodder	Leaves	Drying	Scarce
Andropogongayanus	*Poaceae*	Fodder	leaf blade	Drying	Scarce
Hyparrhennarufa	*Poaceae*	Feed	leaf blade	Drying	Moderate
Danielliaoliveri	*Caesalpininoide*	Fodder	Leaves	Drying	Moderate
Detariummicrocarpum	*Caesalpininoide*	Fodder	Leaves	Drying	Moderate
Ficussur	*Moraceae*	Fodder	Leaves	Drying	Moderate
Khayasenegalensis	*Meliaceae*	Fodder	Leaves	Drying	Moderate
Parkiabiglobosa	*Mimosoideae*	Fodder	Leaves	Drying	Moderate
Pennisetumpedicellatum	*Poaceae*	Feed	Leaf blade	Drying	Abundant
Prosopisafricana	*Sterculaceae*	Fodder	Leaves	Drying	Depleting
Tamarindusindica	*Caesalpininoides*	Fodder	Leaves	Drying	Moderate
Vitexdoniana	*Verbanaceae*	Fodder	Leaves	Drying	Moderate
Terminalia macroptera	*Combretaceae*	Fodder	Leaves	Drying	Moderate
Terminalia glaucescens	*Combretaceae*	Fodder	Fresh leaves	Drying	Moderate

Ecological status source: Obot (1996) and Osemeobo (1999).
Processing sourced from: (i) Locals (ii) Osemeobo (1999).

3.5 Medicinal

Damaged plant species that are of medicinal value to the local people are presented in Table 6. Twenty plant species representing 35.09% of all damaged plants belong to this use category. Also seven hundred and sixty or 41.92% of the damaged parts fall into this category. Some of the species here are *Acacia hockii* and *Vitellariaparadoxa* from which oil is extracted for treating wounds, *Azadirachtaindica*is popularly used for treating malaria, others include *Annona senegalensis* which cures dysentery, *Piliostigma thonningii* which is effective against chest pain and *Ficussur*frequently used as a purgative by the natives. The highest damage was inflicted on *Ximeniaamericana* which lost fifty-one shoots equivalent to 7.02% of the total loss in the medicinal plant use group. All parts of most plant species are useful in treating one ailment or the other. A single plant species can be used to tackle different health challenges and even a part of the same plant are effective in managing different ailment.

Table 5: Damaged plant species used for medicinal purposes

PLANT SPECIES	FAMILY	AILMENT	PART USED	PROCESSING AND APPLICATION
Vitelariaparadoxa	*Sapotaceae*	Treating surface wounds.	Seeds	Ointment is extracted from the seeds and fruits
		For pains	Root and seed	Oil extracted from seed is mixed with dried root ground to powder and rubbed on affected sprains and fraction.
		Fractures and sprains	Root and seed	
Vitexdoniana	*Verbanaceae*	Yellow fever	Bark	Bark of tree soaked water and drink
		Dysentery	Leaves	Leaves boil in water and drink
Acacia gourmaesis	*Mimisoidae*	Managing different kinds of ailments especially body pains	Leaves and bark	Soaked in water, boiled and drink filtrate to cure body pains
Tamarindusindica	*Caesalpinioideae*	Blood tonic	Bark	Soak bark in water and drink filtrate
		Used for wound dressing	Fruit pulp	Dry pulp, grind and spread on wound surface
Anonnasenegalensis	*Annonaceae*	Cure eye problem	leaves	Squeeze to extract liquid
		Cure dysentery	bark	Bark soaked in water and drink filtrate
		Cure guinea worm	fruits	Eaten raw
		Apply to wound to facilitate healing	bark, leaves and root	Pulverize dried leaves and root soaked in water and apply to the wound

Acacia hockii	*Mimisoideae*	Treating wounds	Roots	Roots soaked in water are used to dress wound
Ficuscapensis (Sur)	*Moraceae*	Abscess and skin infection	Leaves	Squeeze leaves to extract liquid and rub on affected parts
		As a purgative to expel intestinal worms	Roots	Soak roots in water, boil and drink to expel worms.
		Purgative	Leaves	Soak leaves in water are boiled, drink to induce purge.
Prosopisafricana	*Sterculaceae*	Fever	Bark	Bark in boiled and water and drink
		Bathing babies	Bark	Bath baby running temperature or rashes with bark boiled in water
Khayasenegalensis	*Meliaceae*	Used as a purgative	Bark	Filtrate from boiled bark is taken
		Treatment of fever	Bark	Bark boiled for drinking
		Stomach ache	Bark	Bark boiled for drinking
		Treating pile	Bark	Soaked in water and drink to treat pile
Adonsoniadigitata	*Bombacaceae*	Toothache	Bark	Bark of plant ground to powder and rubbed on aching tooth. Also bark soaked in water is use giggle mouth to wash to treat tooth ache.
Lanneaacida	*Dipterocarpaceae*	For malaria treatment	Leaves	Filtrate from boiled leaves is taken
		Treating diarrhoea	Roots	Boiled roots in water and drink to stop diarrhoea
Ximenia americana	*Olacaceae*	Cure malaria	Leaves	Leaves are boiled and filtrate taken
		Stomach ache	Roots	Soak leaves in water and drink
Azadirachtaindica	*Verbanaceae*	Cure malaria	Root	Boil or soak in water and drink
			Leaves	Macerate fresh leaves and drink filtrate
				Filtrate from leaves cooked in water is drunk for malaria
Elaeisguineensis	*Arecarceae*	Cure dysentery	Apical leaves	Boiled apical leaves and filtrate taken
		Magical purpose for good luck to overcome difficulties	Apical leaves	Apical leaves dried and ground to powder.
		Used to treat convulsion in children	Late wine	Wine is tapped from the tree and used to bath children.
		Treatment of Rheumatism	Palm kernel oil	Kernel is cracked and oil is extracted and rubbed on the affected part.
		cures mental illness	Apical leaves	Apical leaves are used to prepare spiritual concoction
		Treatment of poisons	Palm oil	Palm oil is given to the patient
		Cure many internal disorders. Applied on boils and wounds.	Palm oil and palm kernel	Palm and kernel oil are extracted and given to the patient
		To cure skin disease		
		To ward off evil spirit	Palm kernel shell and under develop	Soap made from them is used to cure skin disease

			inflorescence.	
			Apical leaves	Tie to the body or building
Terminalia macroptera	*Combretaceae*	Treating wounds.	Bark	Bark is ground to powder and sprayed on the wound.
		Treating dysentery	Bark	Soak bark in water and drink
		Treating fever	Root	Drink and bath with water from root soaked in water.
Anogeissusleiocarpa	*Combretaceae*	Cough	Bark	Soak bark in water and drink filtrate
		Intestinal worms	Bark	Filtrate from bark boiled in water is taken
		Used to ward off evil spirit	Bark	Soak bark in water and use for bathing
		Treatment of convulsion	Bark	Soak bark in water and use for bathing
Vernoniaamygdalina	*Asteraceae*	Fever	Leaves	Boil the leaves in water and give to the patients
		Stomach ache	Leaves	Boil the leaves in water and give to the patients
		Skin diseases	Leaves	Leaves soaked in water is used for bathing
		Hypertension	Leaves	Squeeze leaves in bowl with little water and drink the filtrate
Mangiferaindica	*Anacardiaceae*	Hypertension Insomenia	Leaves	Dried leaves of plant is taken as tea
Azadiracthaindica	*Verbanaceae*	Treating malaria	Leaves	Water from boiled leaves or macerated in cold water is taken by locals
Acacia Senegal	*Mimisoideae*	Treating diarrhoea	Stem	Bores are made on the stem of plant to extract the exudates (Gum Arabic)
		Cures mental illness	Leaves	
Piliostigma thonningii	*Caesalpiniodeae*	Treating old wounds	Leaves	Water squeezed from the leaves or boil leaves in water and use to wash wound surfaces
		Treating: yellow fever Chest pains	Roots	soak leaves in water and drink

3.6 Utilization and Economic

Some of the plant species damaged during the training exercise are used by the local people in the construction of houses, production of agricultural implements, household utensils and different items of furniture. Also some can be harvested and sold to earn additional revenue for the household. Sixteen species serve these functions. Eight species namely *Danielliaoliveri*, *Moneteskestingii*, *Vitexdoniana*e.t.c. are used in the production of household utensil and in housing construction, while six species are used in the manufacture of agricultural implements. Chewing stick is sourced from two of the species, viz., *Prosopsisafricana*and *Terminalia glaucescens*. Many species such as *Moneteskestingii*and *Piliostigma thonningii*among others have multiple use value. They are used to produce more than one item. Some species such as *Elaesisguineensis*, different parts of the plants offer different utility items e.g., palm wine, oil, potash, soap etc. Most often, these items are produced for sale in the market, thereby, contributing to the finances of the family. The total plant shoots lost in this use group was 494 or 27.25% of the total shoot loss.

Table 6: Damaged plant species used for economic and household items

NAME OF PLANT	FAMILY	USES	PART USED	ECOLOGICAL STATUS
Anogeissusleiocarpus	*Combretaceae*	▪ Agric implement wood used to produce poles. ▪ Housing construction	Wood	Scarce
Lanneaacida	*Dipterocarpaceae*	Wood use in carpentry works	Bole	Depleting due to deforestation
AfzeliaAfricana	*Caesalpiniodeae*	For Agric implements	Wood	Scarce
Combretumnigricans	*Combretaceae*	Housing construction	Wood	Depleting due to deforestation
Danielliaoliveri	*Caesalpiniodeae*	Housing constructing and Agricultural household implement	Wood	Moderate
Monoteskerstingii	*Dipterocarpaceae*	Housing construction, Agricultural household implement	Wood	Scarce
Piliostigma thonningii	*Caesalpiniodeae*	Agricultural and household implement	Bole	Overcutting of trees
Vitexdoniana	*Verbanaceae*	Agricultural and household implement.	Wood	Moderate
Isoberlinadoka	*Caesalpiniodeae*	Fuel wood.	Wood	Abundant
ProsopisAfricana	*Sterculaceae*	Mortar and pestle	Bole	Moderate
		Used as chewing stick.	Wood	
Khayasenegalensis	*Meliaceae*	Making beds and other furniture items	Bole	Depletion due to habitat loss
Adansoniadigitata	*Bombacaceae*	• Making rope • Ash from burnt wood used as fertilizer • Housing construction	Bark Wood • Wood	Moderate
Elaeisguineensis	*Arecarceae*	▪ Stem used as building poles for rural house ▪ Midrib of leaflet used for making brooms. ▪ The infractions used for making native potash. ▪ The potash and its oil are used for making black soap. ▪ Fuel for cooking. ▪ Making basket ▪ Making ropes ▪ Skin oil	▪ Stem ▪ Leaf/Corm • Midrib of leaflets ▪ Infraction ▪ Fibre from the fruit. ▪ Frond. ▪ Frond. ▪ Kernel.	Moderate
Ceibapentandra.	*Bombacaceae*	Stuffing pillows and mattresses	Cotton	Depleted
Vitalleriaparadoxa	*Sapotaceae*	Fruits used in industries	Fruit	Abundant
Terminalia glaucescens.	*Combretaceae*	Chewing stick	Roots	

4.0 DISCUSSION

People have always lived among plants and evolved alongside with them (Kaeslin and Williamson, 2010), but the army combat training exercise impacted negatively on the wild plant resources on which the indigenous community and the wildlife in the ecosystem depend on for their sustenance. Akobundu *et al* (1993) have submitted that natural vegetation is a store house of abundant natural resources. Fifteen of the damaged plant species are sources of food to indigenous community and the wildlife in the ecosystem. Etkin and Ross (1994) had similarly identified 119 wild plant species which serve as food to the Hausa community in the savanna ecozone of Nigeria. Okafor (1993) in another study recorded 17 wild plants food species from the Southern Guinea savanna zone which play major role in the nutritional requirement of savanna inhabitant. Osemeobo (1990) documented eight plant species used as food in the savanna. Most of the species reported by these authors were also identified in this study.The above indicate that savanna vegetation is a major source of food resources to the local people which military activity play a significant but often neglected role in their depletion through the use of explosives, armoured tanks, artillery, trucks, digging of trenches and deliberate acts of devegetation

for camouflage and other uses. This position is in tandem with the submission of Quist *et al*(2003) who reported that combat training in terrestrial ecosystem is associated with reduced plant species, richness and diversity.

The result further revealed that most of the used parts are the fruits. This is consistent with the submission of Gumbo *et al* (1990) and Toulmin (1986) who opined that fruits from the wild are used to augment the daily diet of the rural poor especially during drought. Fruits are rich in mineral and vitamins and are used by locals to supplement their carbohydrate rich diet. Also, most wild fruits are important food sources during period of drought when cultivated food is scarce thereby providing dietary support to the rural poor. In addition, wild fruits serve as food to wildlife in the study area and this has also been reported in Zimbabwe by Campbell *et al*(1987). The rural poor who cannot afford animal protein often compensate with wild vegetable rich diet which in addition to providing vitamins and minerals, occasionally serve as whole meal to them.

Most importantly, the local people depend on wild food plant species as buffers during period of stress. Jodha (1986, 1991) and Saxene (1979) similarly submitted that food from wild plants is a major source of dietary supply for the rural people during period of food scarcity. Earlier, Irivine (1952) had reported that vegetables and fruits are wild famine food for the rural poor. Plants like *Vitex doniana, Ficus sur,* among others produce new flush of leaves during the dry season and are therefore suitable food buffers during drought. It has also been documented in Sudan that 91% of rural people depend on wild grains for food during famine (De Waal, 1989). Therefore, the capacity of wild species to fruit during the dry months guarantees continuous supply of food, thereby, ensuring food security to the populations that depend on them. The damaged vegetation is also habitat for a large insect population. These insects in addition to their many beneficial roles such as pollination of flowers are eaten as part of the diet of the people of Kachia. Vantomme (2010) reported that over 1400 insect species are eaten worldwide and most of them are harvested from natural vegetation.

This research also identified ten species from among the damaged plant species which are used by the indigenous peoples for soup and spices. Four of these species had been identified by Osemeobo (1999). This result is in agreement with Etkin and Ross (1984) who submitted that food of savanna inhabitants were eaten with soup made from a variety of wild plants. This is also supported by Guijt (1998) who documented some fruits and seeds from savannavegetation which women collect for preparing assorted sauces. The use of fruit and seed as soup condiments and spices is nationwide. Isichei (2005) listed five species used as spices, six species as used soup condiments and six species of plants used as sweeteners. All these are harvested and used by the local people from the wild plants at no cost.

Fodder is consumed by livestock and the savanna host over 90% of livestock and a large number of foraging animals in Nigeria (Osemeobo, 1996). Seventeen plant species that serve as fodder and forage species were damaged during the exercise. Le Houerou (1991) identified 20 fodder species and 22 browser genera from the wild. Similarly, (Osemeobo, 1999) identified 28 fodder species and 14 forage species in the savanna. The 17 species identified in this research is high but could decrease if regular military activities in the environment are not checked. Fodder is critical to the survival of livestock in the savanna during the dry season and fodder produced in the savanna area account for 10-15% of the total livestock feed in the savanna zone in the dry season (Osemeobo, 1996). They have an added value that most useful fodder species produce new flush of leaves and flowers in the dry season which are rich in protein, vitamins and minerals. With the expansion of agricultural land and urbanization in Kachia, this training area may be the last resort where the indigenous community will source for fodder to feed their livestock.

The use of medicinal plants for the treatment of different ailments in the savanna area of Nigeria is as old as man. Twenty plant species that were damaged during the exercise have medicinal value. This is unfortunate as the use of medicinal plants in Nigeria is enjoying wide patronage. The cost of accessing orthodox medicine and the high poverty level among the rural populace may have been responsible in promoting the use of herbal medicine. Adjanohoun *et al*(1996) identified 279 medicinal plant species in South Western Nigeria. Obot (1996) identified 18 medicinal plant species in the savanna. In Gashaka-Gumti National Park, 30 medicinal plant species were identified (Akinsoji, 2003) while Etkin and Ross (1994) compiled wild savanna plants useful in herbal medication. Over 90% of Nigerian in rural areas depends on herbal medicine while 40% of urban dwellers depend partly or wholly on herbal medication (Isichei, 2005). Some of these plants like *Vitellaria paradoxa, Azadirachta indica, Mitragyora inermis and Vernona amygdalina* have been used by the local people in their health care delivery over the years. This has been collaborated by Maundu (1987) who reported that Kenyan people believe that traditional medicine have stronger curative power than modern medicine. This could be due to the fact that most medicinal plants serve as food also, and so the nutritional phytochemicals in them help to beef up resistance in the otherwise malnourished local people. Also traditional medicine is closely tied to traditional religion. Consequently, many herbal plants are curative or preventive and even most of them like *Elaesis guineensis* are used in divination and magic by the local people. The report of Walker (1999) that the method of collection, preparation and administration is linked to magic in order to be efficacious, support to this claim.

An economic evaluation of damaged species during the training operation revealed that twenty plant species

offer economic benefits to the indigenous community. Guijt (1998) have submitted that wild plant resources offer cash benefits to the people indirectly by preventing the need for cash expenditure. A publication by the Hot Spring Working Group (1995) identified a range of plants that offer different economic benefits to the local people in Zimbabwe. The local people in the study area harvest fruits of *Mangifera indica, Parkia biglobosa, Vitellaria paradoxa, Elaesis guineensis* and the leaves of plants species used for medicine and fodder, for sale in local or distant markets to augment family finances. Morakinyo (1994) observed that the people of Ekuri community in the support zone of Cross River State National Park, Nigeria, identified five principal non-timber products including chewing stick that are of commercial important. In the study area, production of palm oil, basket, palm kernel oil and soap from *Elaesisguineensis* are flourishing commercial ventures. Dawadawa from *Parkiaspp* and *Tamarindusindica*are processed by indigenous people into local fruit juice for sale. Akinsoji (1996) has also recommended that plant like *Daniellia, Elaesis and Vitalleria* that produce copious seeds, can be used in small scale vegetable oil extraction.

The vegetation in the study area provides raw materials for building purposes, tools and weapons, household utensil among other items to the local inhabitants. Akinsoji (2003) also reported twenty-one, seven and fifteen plant species used for construction of houses, furniture and agricultural implements respectively while Osemeobo (1999) also identified thirty plants species in Nigeria used in constructing huts, house utensils, furniture etc. Some of the constructed items are also sold in the market to bring additional cash home. The houses in the study area constructed by Fulani herdsmen and local silos used for grain storage are made of mud but the roofing materials namely grasses, leaves, poles and palm fronds are sourced from the wild at no cost.

Most of the damage species have “other use” values, i.e., cultural religious, environmental and existence. These values are often overlooked and consequently treated as useless. Osemeobo (1993) has submitted that traditional religion, culture and traditional medicine are inseparable. Some species are used in divination and shrine worship. The leaves of *Newbouldia leavis* are used in shrines and divination against evil spirits, while the apical leaves of *Elaesis guineensis* are used in worship, magical purposes for good luck, ward off evil spirit, tie corpse and washing. These cultural and spiritual values of damaged plant species cannot easily be appreciated or expressed in monetary terms.

5.0 CONCLUSION AND RECOMMENDATION

Damage to the natural resources in training sites will hit the poorest of the poor in the environment hardest. This study has exposed the need to integrate the suitability of a chosen training arena with the potential loss of natural resources that might come to the local people through collateral damage that may be inflicted on the biota. There is need therefore to establish the use value of all plant species in the training area. The army should undertake a total wilderness resource assessment or study the biodiversity use of these plant species based on local community perspective. Lt. Col. Quintin Hogg cited by Hopkins, after a training exercise in Olokomeji forest reserve wrote “If I had been told about the natural resources in this reserve, I would have been less prodigal in my use of explosives”. Participation by the local people in such inventorization is advocated as this will position or equip the community in negotiating for better deals with more powerful external interest. A sound environmental education for officers and men of the armed forces has become more imperative. Finally, it should be pointed out that wild resources are site specific and thus prone to rarity and extinction.

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