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PHYTOSOCIOLOGICAL ATTRIBUTES OF AQUATIC WEEDS OF KANO-HADEJA-NGURU WETLANDS

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ABSTRACT
A survey was conducted during dry and rainy seasons of 2011 in order to determine the phyto-sociological attributes of acquatic weeds of Kano-Hadeja-Nguru wetlands. Random quadrat method was adopted for the phytosociological studies. The study areas consisted of communities from Kano, Jigawa and Yobe States. In each state, six communities were randomly selected. In each community20 quadrats of 4 m^2 size were laid down and hence sum of 120 quadrats were randomly thrown for each state. Within each quadrat area, weeds were identified, counted and weed cover scores were recorded. Weeds were cut at ground level, fresh and dry weights were determined. Typha grass was the most dominant species in the wetlands of Jigawa (21.195 and 22.5%) compared to either Kano (9.345 and 5.27%) or Yobe (12.73 and12.135%) states. Weed density, weed cover scores as well as fresh and dry weight of weed samples from Kano were observed to be higher than the other two states. Morphological characteristics of Typha spp found in Kano State were taller with more leaves than the other two states. The study suggested that there is strong need to start an Integrated Typha management in the study areas.
Keywords: Phytosocioloy, aquatic weed, wetlands, Typha morphology

INTRODUCTION

Aquatic plants are natural part of the aquatic ecosystems used by many animals either as food or as a hiding place. Many people find aquatic plants interesting and attractive. However, as with any naturally occurring organism, they may interfere with people's activities either as over-abundant or by their mere presence. Many communities along the Kano-Hadejia-Nguru floodplains are adversely affected by problems associated with aquatic weed invasion. The Kano-Hadejia-Nguru wetlands are very rich in human and natural resources to support rapid economic development of the region. *Typha* and many other aquatic weeds remain the main stumbling block to effective exploitation and utilization of these resources as the economy of the wetlands is dependent on free flow of water. The presence of *Typha* creates a lot of problems to the farmers in the study area. Most importantly, it provides conducive environment for quelea birds which destroy cereal crops. *Typha* grow very fast, colonized a given habitat and claimed several hectares of irrigable lands rendering them inaccessible for any cropping activities. Where ever it occurs, *Typha* block water ways and cause conflict among water users in the upper and lower streams, makes fishing activities impossible and provide cover for dangerous animals like snake as confirmed by the farmers in the study area.The menace of aquatic weeds in the region is devastating; decreases productivity of agricultural systems andconsequently lowering economic activities and general livelihood (food insecurity, poverty, unemployment, etc.). The blockage also leads to over flow of water to many farm lands, rendering them inaccessible for farming activities. The dense weed cover makes water transportation very difficult. Also the blockages result in higher water table leading to high salt build up. Furthermore, dead and decomposed *Typha* plants cause siltation and flooding.

Weed survey is an important tool for determining occurrence and relative importance of weed species in a given ecosystem (Frick and Thomas, 1992). It is also necessary for proper quantification which allows rigorous statistical and mathematical evaluation of plant community trends and assessments of the effectiveness of various management techniques. Detail knowledge of weed species allows proper distribution of herbicide which helps in inhibiting their growth. The knowledge of weed population dynamics, occurrence and herbage cover is important in identifying problem weeds associated of an area (Ghafoor*et al*, 1987). The Hadejia-Nguru wetland is composed of diverse flora of weeds infesting water bodies and its surrounding. No report on weeds and their distribution pattern of the wetland has been reported. Information on aquatic weeds biology and phytosociolgy is a fundamental prerequisite for successful weedcontrol. The objective of the study was to identify the most dominant weed species in the study area with a view of designing suitable control measures.

MATERIAL AND METHODS

Description of the Experimental Site

The study area span across the flood plain in three states, stretching from Kano through Jigawa to Yobe States of northern Nigeria (Figure 1). The field survey was carried out in rainy and dry seasons of 2011 to assess the extent ofweed infestation in Kano-Hadeja-Nguru wetlands. The study area covers thousands hectares of land. Table 1 provides the list of experimental sites and their coordinate in each state. Due to the abundant water supplies, a lot of farming activities take place both in the rainy and dry seasons. The presence of water bodies provides a continues supply of fresh pasture and this attracts the presence of many herds' men throughout the year.

Sampling Procedure

In each state, six sites(weed infested water bodies) were selected at random and in each site, 20 sampling points were considered. Random quadrat method was adopted for the study of phytosociological attributes of the weeds. In each field site, 20 quadrats of 400 cm^2 were laid down at random. All the weedswithin the quadrat werecounted and collected in polythene bags and identified using standard text according to Akobunduand Agyakwa (1998), and Johnson (1997).

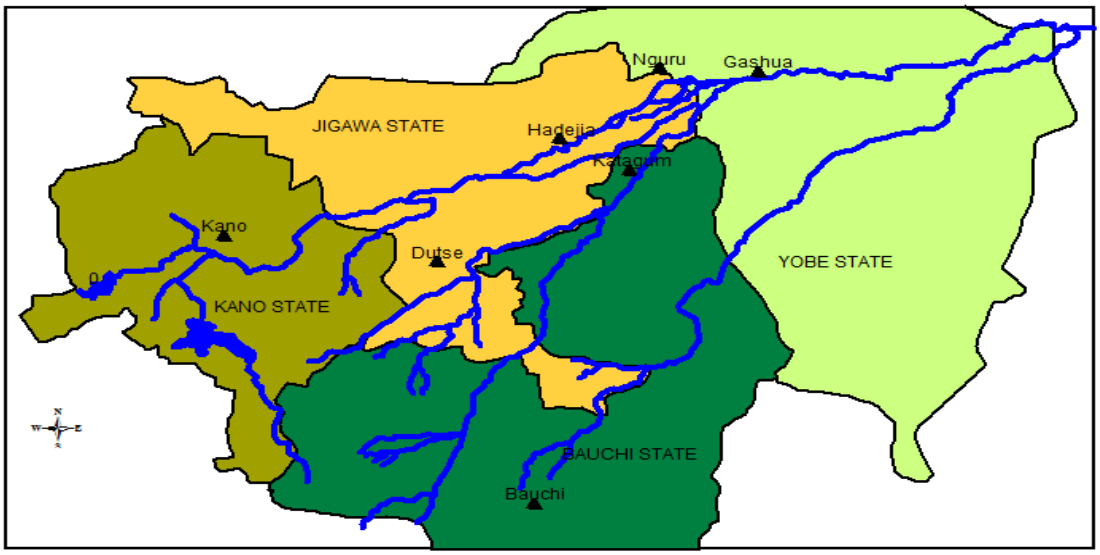

Figure 1: Map showing the river network in the study area

Table 1. Experimental communities in Jigawa, Kano and Yobe State

Communities	Latitude	Langitetude	Altitude M	Habitat
Jigawa State				
Adiyani	12°48'31"	10°25'56"	376	Flood plain
Dingaren Miga	12°19'21"	9°46'31"	396	Dam
Gishinawo	12°32'49"	10°17'37"	362	Flood plain
Kuradige	12°43'57"	10°20'50"	361	Flood plain
Kabak	12°41'10"	10°19'06"	366	Flood plain
Likori	12°8.078′	10°16.960′	355	Flood plain
Kano State				
Munture	11°31.001'	8°27.379'	510	Dam
Garin Babba	11°35.992'	8°26.494'	510	Canal
Refawa gabas	11°33.195'	8°27.549'	509	Canal
Refawa yamma	11°32.338'	8°27.289'	512	Canal
Ruwan Kanya	12°07.728'	9°16.368'	513	Dam
Zangon Bahari	11°39.436'	8°32.833'	493	anal
Yobe State				
Dabar A. Giwa	12°47.89'	10°28.846'	352	River
Garbi	12°48.289'	10°33.587'	361	Flood plain
Dumsai	12°52.543'	10°38.437'	338	Flood plain
Nguru lake	12°50.561'	10°26.156'	338	Flood plain
Sabongarin Mal. Ibrahim	12°49'52"	10°18'02"	368.5	Fadama
Saleri	12°50'01"	10°19'36"	378.5	Fadama

Data Collection and Analysis

The height of the dominant weed was measured using meter rule and number of leaves plant^{-1} of the species was also recorded. Weed cover score was determined by visual observation using scale of 1-10 where 1= free uncovered space, 10 =completely weed covered. All the plant species encountered in the quadrat at each site were cut and dried at 75^{o}C to constant weight. The phytosociological attributes such as relative density and frequency and Summed domance ratio were calculated according to the principles of Curtis and Mclntosh (1950), Misra (1968) and Dombois and Ellenberg (1974). The formulae for calculation of the relevant attributes were:

$$Relative\ frequency = \frac{Frequency\ of\ individuals\ of\ a\ species\ x\ 100}{Total\ frequency\ of\ all\ species}$$

$$Relative\ density = \frac{Density\ of\ individuals\ of\ a\ species\ x\ 100}{Total\ density\ of\ all\ species}$$

$$Summed\ domance\ ratio = \frac{Relative\ Frequency + Relative\ Density}{2}$$

RESULTS AND DISCUSSION

Relative frequency, relative density and summed domance ratio(SDR) of weed species encountered in Kano-Hadeja-Nguru wetland are presented in Tables 2 and 3. Atotal of 21 weed species (8narrow leaved, 11 broadleaf and 2 sedges) were recorded from 300 randomly thrown quad rats in the three states during dry season. In the rainy season a total of 22 weed species (9 narrow leaved, 11 broadleaf and 2 sedges) were recorded. Weber *et al.* (1995)reported 74 weed species in intensified cereal-based cropping systems in northern Guinea savanna of Nigeria under terrestrial condition. The results indicated that only three narrow leaved species (*Cynodon dactylon, Sorghum halepans* and *Typha* species) consistently appeared in all locations in both seasons indicating their wide spread. This could be attributed to the fact that they are perennial in nature with diverse forms of propagatory materials (Akobundu and Agyakwa (1998)). Ten (10) broadleaf species constituting 42% of the total weed species (*Ageratum conyzoides, Azolla pinnata*, *Eichornia natans*, *Hydrilla species, Ipomea asorifolia, Melochia corchorifolia, Nymphaea lotus, Phyllanthus amarus, Polygonum salicifolium* and *Portulaca oleraceae)* were found in Jigawa State during the dry seasons. Nine broadleaf species constituting 45% of the total weed species were enumerated in the State during rainy season. In Kano state 7 and 4 broadleaved species constituting 33% and 18% of the weeds were recorded in dry and rainy seasons respectively while in Yobe State only 7 and 5 broad leaved species representing33.3% and 22.7% of the weeds were encountered in dry and rainy seasons, respectively. *Cyperus difformis* was the only sedge that appeared in Jigawa and Kano States in both seasons while in Yobe State two sedges species (*Cyperus difformis* and *Sceneplectus senegalinsis)* were enumerated. This suggested wide variations of weed flora across the flood plain in the three States. Study conducted by Weber *et al.* (1995) in cereal-based cropping system of northern Guinea savanna reported wide variation on weed occurrences among communities in Northern states of Nigeria. Similarly, Yakubu *et al.* (2006), observed significant variation among aquatic weeds of Wara Irrigation Project in Kebbi State, Nigeria.

The relative frequency and density of the weed species in Kano- Hadeja -Nguru wetlands revealed that *Typha* species was more frequent in the water bodies of all the states. *Typha* was more frequent in Jigawa (18.95% and 20.88%) compared to Yobe (10.62% and 11.89%) and Kano (7.74 and 4.98%) states. It is the only species with relative density of $\geq$ 10% in all the States in both seasons except in Kano in both seasons where a lower relative density was observed. *Typha* species had the highest relative density of 23.44% in the dry season and 24.12% during rainy season in Jigawa State. In Yobe State, the relative density of the species was 14.84% in the dry season (Table 2) and 12.38% in the rainy season (Table 3). *Typha* species recorded the lowest relative density in Kano state with 10.95% in the dry season (Table 2) and only 5.56% in the rainy season (Table3). Because of its higher relative frequency and density, *Typha* species had higher SDR than the other species in all the three States. This is because of the fact that wetlands provide suitable habitat for growth and development of this weed as reported by Akobundu (1987)**.**This indicated that the *Typha*is the most important species in the wetland in both seasons. *Sorghum halepans* appeared to be the most important weed species enumerated in Kano State in both seasons with the highest SDR. Farmers in the study area believed that wide spread of *Sorghum halepans* might be responsible for low spread of *Typha* species possibly because of the alleophatic effects it may have on *Typha*. But the species is believed to causea lot of problems similar to *Typha*.

The results revealed that Kano state had the highest weed cover score, weed density (M^{-2}) as well as weed fresh and dry weight than Jigawa and Yobe States respectively in both seasons (Figures2&3). This may possibly be due to the differences in habitat where the survey was conducted. In Kano, the habitats are mostly dam and canals where there is permanent supply of

water throughout the year. Habitats of Jigawa and Yobe States are natural flood plains with seasonal water shortage that can affect growth and development of all aquatic life. This account for low weed cover scores as well as fresh and dry weight of weeds. These were further confirmed by morphological characteristics of the *Typha* plant identified in the respective States which indicates that the species of Kano are taller with more number of leaves than those of the other two states (Figure 2). The weed densities recorded in each state were more than 10 m^{-2}. It is generally agreed that a weed plant species of more than 1 m^{-2} may have perceptible impact on the crop under terrestrial condition (Pragada and Venkaiah, 2012). Therefore in aquatic environment the impact may triple. High weed cover score creates a problem to fishing communities. Submerged aquatic weeds are particularly undesirable because fish harvesting seines will ride up over the weeds and allow fish to escape. Water bodies with dense weed infestations can be impossible to harvest since the weight of the weeds accumulating in the seine net can become too heavy to be pulled (Das, 2011).

CONCLUSION

The results of the study revealed that a wide diversity of weed species existed in Kano-Hadeja-Nguru wetlands. *Typha* species was identified to be the most important species in all the States with Jigawa State recording the highest infestation. Therefore there is an urgent need to control this weed in order to protect the water bodies. The control measures should focus on destruction of underground rhizomes by either mechanical means, systemic herbicide or both. This may help in controlling not only *Typha,* but all other weeds species. It will enhance agricultural productivity; create job opportunities among youth and alleviate hunger and poverty there by making the community to be food secured. Searching for suitable weed control measures is therefore recommended in the study area. If these weeds are controlled, the livelihood and economic activities of the people living around the wetland will certainly be improved. Further investigation of the allelophatic effect of *Sorghum halepans* on *Typha* species was suggested.

Contribution of authors:

1. A. Lado: Data collection, species identification and write-up
2. M. U. Dawaki: Write-up and editing
3. M. A. Hussaini: Lead scientist
4. I. B. Muhammad: Write-up and editing

CONFLICT OF INTEREST: None

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Table 2. Phytosociological Attributes of Weed Flora Species of Kano—Hadejia_Ngru Wetlands in 2010 dry seasons

Weed species	Relative density%			Total	Relative frequency %			Total	Summed dormance Ratio			Total
	Jigawa	Kano	Yobe		Jigawa	Kano	Yobe		Jigawa	Kano	Yobe	
Narow leaved species												
Annience beinice	0	0	0.01	0.01	0	0	0.12	0.12	0	0	0.065	0.065
Cynodon dactylon	0.03	0.05	0	0.08	0.13	0.04	0	0.17	0.08	0.045	0	0.125
Eichinocloa crus-povonis	1.2	1	1.18	3.38	0.69	0.72	0.54	1.95	0.945	0.86	0.86	2.665
Eichinocloa colona	2.04	2.71	2	6.75	3.29	3.37	2	8.66	2.665	3.04	2	7.705
Eleusine indica	2.75	1.16	2.56	6.47	3.83	1.71	2.58	8.12	3.29	1.435	2.57	7.295
Oryza longiostaminata	2.89	2	4.58	9.47	5.82	2	2.69	10.51	4.355	2	3.635	9.99
Sorghum halepans	0.01	7.79	0.08	7.88	0.17	6.16	0.5	6.83	0.09	6.975	0.29	7.355
Typha species	23.44	10.95	14.84	49.23	18.95	7.74	10.62	37.31	21.195	9.345	12.73	43.27
Broad leaved species												
Euphorbia heterophylla	0	0	0.01	0.01	0	0	0.21	0.21	0	0	0.11	0.11
Heteranthera callifolia	0.5	0	0	0.5	0.39	0	0	0.39	0.445	0	0	0.445
Hydrilla	0.02	0.04	0.52	0.58	0.43	0.71	1.6	2.74	0.225	0.375	1.06	1.66
Ipomea aquatic	2.02	1.11	1.08	4.21	2.25	1.39	1.09	4.73	2.135	1.25	1.085	4.47
Ipomea asoriforlia	1	0.07	0	1.07	0.19	0.39	0	0.58	0.595	0.23	0	0.825
Ludwiga deaurrens	0	0.24	0	0.24	0	0.44	0	0.44	0	0.34	0	0.34
Murdannia keisak	0.04	0.1	0.17	0.31	0.36	0.59	0.89	1.84	0.2	0.345	0.53	1.075
Nyphaea lotus	2.21	1.07	1.6	4.88	3.19	1.39	4.34	8.92	2.7	1.23	2.97	6.9
Pistia stratiotes	0.12	0	0.1	0.22	0.23	0	0.24	0.47	0.175	0	0.17	0.345
Polygonum ariforlinum	0.02	0.26	0	0.28	0.17	1.03	0	1.2	0.095	0.645	0	0.74
Utricularia inflexa	0.23	0	0.12	0.35	0.23	0	0.52	0.75	0.23	0	0.32	0.55
Sedges												
Cyperus difformis	1.37	1.62	0.81	3.8	1.67	1.35	0.82	3.84	1.52	1.485	0.815	3.82
Scheneplectus senegalinsis	0	0	0.28	0.28	0	0	0.12	0.12	0	0	0.2	0.2
Total	**39.89**	**30.17**	**29.94**	**100**	**41.99**	**29.03**	**28.88**	**99.9**	**40.94**	**29.6**	**29.41**	**99.95**

Table 3. Phytosociological Attributes of Weed Flora Species of Kano-Hadejia-Ngru Wetlands in 2010 dry season

Weed species	Relative density%				Relative frequency %				Summed dormance Ratio%			
	Jigawa	Kano	Yobe	Total	Jigawa	Kano	Yobe	Total	Jigawa	Kano	Yobe	Total
Narrowleaf spp												
Annience beinice	0	0	0.16	0.16	0	0	0.37	0.37	0	0	0.265	0.265
Cynodon dactylon	1.01	0.61	0.01	1.63	1.33	0.53	0.001	1.861	1.17	0.57	0.0055	1.7455
Eichinocloa crus-povonis	1.78	4.24	0.17	6.19	0.74	5.8	0.27	6.81	1.26	5.02	0.22	6.5
Eichinocloa colona	1.52	0.92	0	2.44	0.72	0.69	0	1.41	1.12	0.805	0	1.925
Eichinocloa naptan	0.74	3.24	0	3.98	0.77	2.86	0	3.63	0.755	3.05	0	3.805
Eleusine indica	1	2.15	1.22	4.37	0.5	2.89	3.18	6.57	0.75	2.52	2.2	5.47
Oryza longiostaminata	6.51	2.07	3.35	11.93	6.23	2.04	3.32	11.59	6.37	2.055	3.335	11.76
Sorghum halepans	1.44	10.23	1.06	12.73	1.53	8.09	0.5	10.12	1.485	9.16	0.78	11.425
Typha species	24.12	5.56	12.38	42.06	20.88	4.98	11.89	37.75	22.5	5.27	12.135	39.905
Broadleaf												
Ageratum conyzoides	0	1.25	0	1.25	0.11	2.96	0	3.07	0.055	2.105	0	2.16
Azolla pinnata	2.08	0	0	2.08	2.1	0	0	2.1	2.09	0	0	2.09
Eichornia crissipes	0.22	0	0	0.22	0.18	0	0	0.18	0.2	0	0	0.2
Hydrilla	1.09	0.34	0	1.43	0.42	0.69	0	1.11	0.755	0.515	0	1.27
Ipomea aquatic	0	0.03	0.17	0.2	0	0.51	0.49	1	0	0.27	0.33	0.6
Ipomea asoriforlia	0.3	0	0	0.3	0.96	0	0	0.96	0.63	0	0	0.63
Melochia corchorifolia	0.15	0	0.09	0.24	0.3	0	0.41	0.71	0.225	0	0.25	0.475
Nyphaea lotus	1.08	0	0.65	1.73	0.37	0	0.82	1.19	0.725	0	0.735	1.46
Phyllanthus amarus	0.08	0	0.02	0.1	0.37	0	0.23	0.6	0.225	0	0.125	0.35
Polygonum ariforlinum	1.21	0.8	1.29	3.3	0.7	2.05	2.35	5.1	0.955	1.425	1.82	4.2
Portulaca oleraceae	0	0	0	0	0.16	0	0	0.16	0.08	0	0	0.08
Sedges												
Cyperus difformis	1.1	1.19	0.34	2.63	1.57	1.39	0.27	3.23	1.335	1.29	0.305	2.93
Scheneplectus senegalinsis	0	0	1.03	1.03	0	0	0.41	0.41	0	0	0.72	0.72
Total	**45.43**	**32.63**	**21.94**	**100**	**39.94**	**35.48**	**24.51**	**99.93**	**42.69**	**34.06**	**23.23**	**99.97**

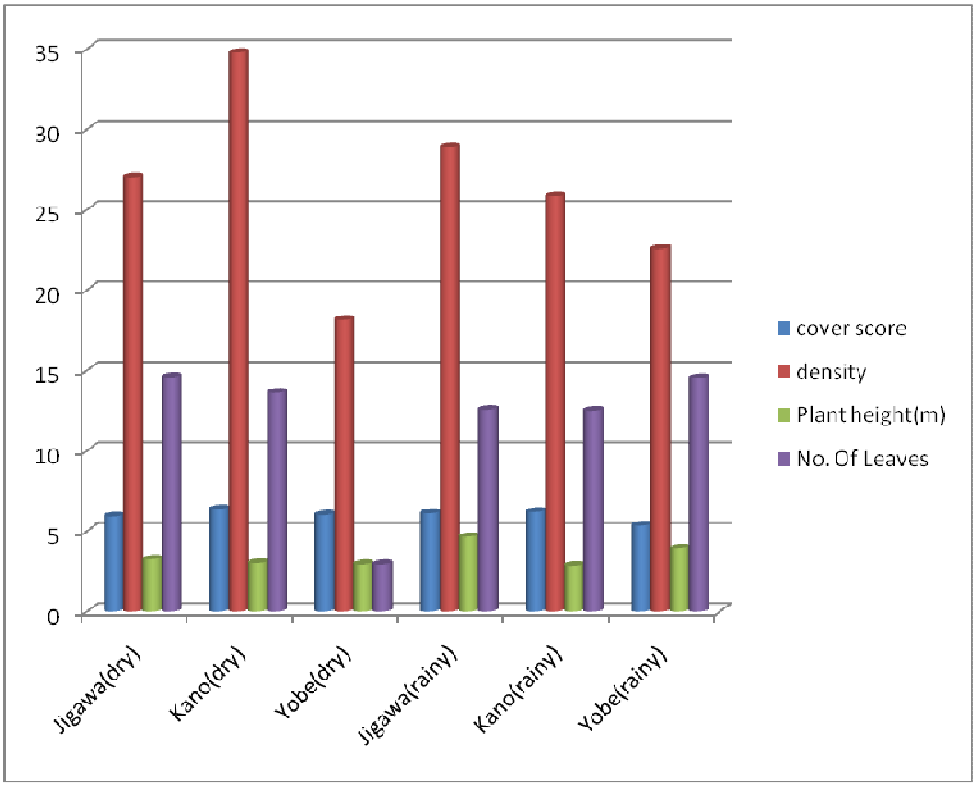

Figure 2. Phytosociology of aquatic weeds of some selected Typha infested areas of Jigawa, Kano and Yobe States

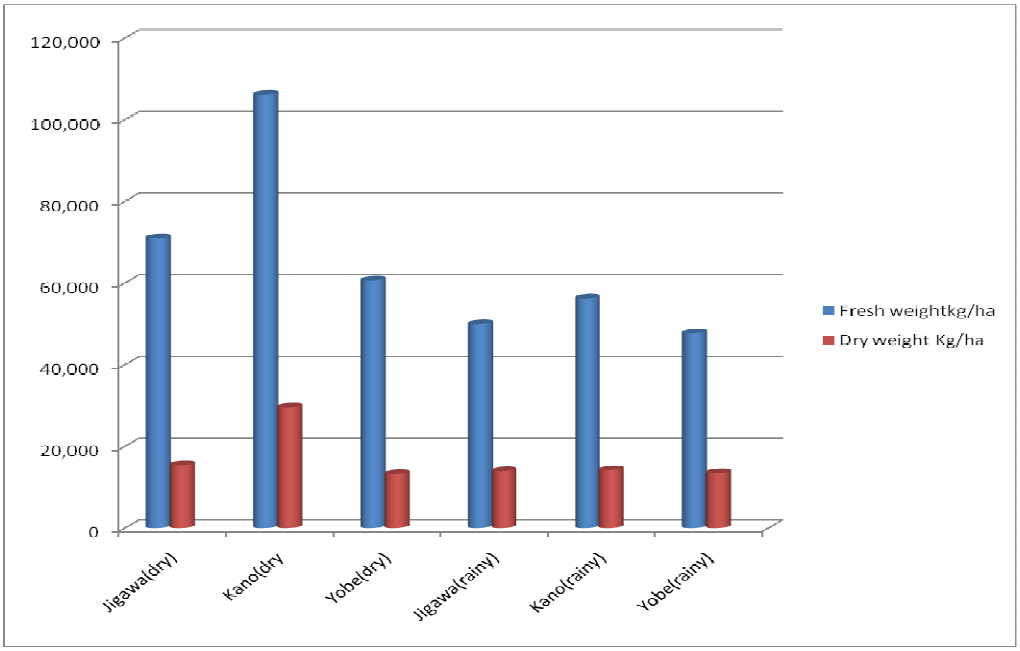

Figure 3: Weed fresh and dry weight of Aquatic weeds of Jigawa, Kano and Yobe States