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TYPHA GRASS (Typha Domingensis) AND ITS CONTROL STRATEGIES ALONG NGURU WETLANDS,YOBE STATE, NIGERIA.

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ABSTRACT

The study was conducted in the months of July-September 2017 to assess strategies used for the control of the invasive Typha grass (Typhadomingensis) along Nguru wetlands, Yobe state, Nigeria. Three towns namely; Nguru, Kakori and DogonKuka all along the Nguru wetlands in Nguru Local Government Area of Yobe State were selected for the study.A total of 171 respondents comprising of local communities and officials of the Hadejia Nguru Wetland Conservation Project (HNWCP) and Komodougu Yobe Basin Wetlands Development Initiative (KYB-WDI)selected using Convenient, Snowball and Systematic Random sampling techniques participated in the study. Descriptive Survey method of research study was employed while data was collected using closed ended self made questionnaires and structured Interview Guide. Data collected was analyzed in SPSS Version 6 using the Frequency, Percentage, Mean and Standard Deviation distribution tables. The study discovered that the task of controlling typha invasion was so big and efforts put in by government and other related agencies were not enough. However, efforts of the Federal Government of Nigeria were commendable. Manual cutting, burning and use of herbicides were the most widely used control methods by the local communities. The locals could not afford the clearance of typha alone so usually employ the services of others in spite the fact that no assistance of any form is given to them by the government. Controlling typha invasion greatly affected farmers' productivity while effectiveness of the control efforts were affected by certain factors such as the rapid natural spread capability of the grass, poverty etc. Conservation agencies stated some challenges being faced in the control of typha proliferation which included poor funding, farmers' illiteracy and

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lukewarm attitude of the government, lack of working tools and equipments and so on. Based on the findings made, it is recommended that efficient methods of controlling typha grass that are used in other countries and proved to be effective such as the careful and controlled use of herbicides, Lake draw-down methods and biological methods should be employed.

Key Words : Typha grass, control strategies, local communities, Nguru wetlands.

INTRODUCTION

While some view wetlands as wasted land, in reality they are one of the most valuable resources. Indeed, its importance to man and the environment cannot be overstated. For this reason, many wetlands, particularly the larger ones and those bordering the Great Lakes are protected by state and federal laws. Besides the creation of avenues for farming, irrigation, fishing, recreation and grazing which are the openly known benefits of wetlands, other benefits include: helping to control flooding and storm water, protecting water quality by filtering and breaking down sediments, nutrients, and toxins and then slowly releasing the water to recharge the ground water, providing habitat for many different species of wildlife including fish, insects etc, providing numerous recreational opportunities, for fishing, bird watching etc. Other benefits include, treating pollution by serving as a biological and chemical oxidation basin, controlling erosion by serving as a sedimentation area and filtering basin for slit and organic matter as well as providing avenue for fishing, farming and irrigation farming (www.mywatersheds.org).

The Nguru wetlands located in the north eastern part of Nigeria particularly in Yobe state, is a part of the Hedejia-Nguru Wetlands (HNWs) located in an area in the southern edge of the Sahel Savanna in north eastern Nigeria comprising of permanent lakes and seasonally flooded pool connected by a network of channels.(Ringim, et. al., 2015). The wetland complex is formed by the Hedejia –Jama'are Rivers which drain into Lake Chad. The wetlands cover an area of about 3,500 km2 (Birdlife international, 2015). Besides, the wetland supports at least 250 species of flowering plants, over 136 types of aquatic flora and fauna, more than 13 species of fishes and 378 species of birds (Oduntanet. al., 2010). About 1.5 million people depend on the wetlands ecosystem for their livelihood in the form of agriculture, grazing resources, non timber forest resources, fuel wood and fishing. It is one of the sites declared as Ramsar sites in Nigeria. The wetlands serve as a major source of fish, supplying approximately 6% of Nigeria's inland fish catch with a market value of nearly US $300s,000 per annum (Birdlife International, 2015).

However, the Hadejia-Nguru Wetlands (HNWs) is confronted by multiple natural, ecological, social and economic problems. (Haladu and Bello, 2014). For instance, there are natural changes, for example the impacts of drought, that have serious implications for the future of the wetlands and the sustainability of their production systems. There are also major economic changes within

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the wetlands themselves such as the increase in irrigation largely as a result of the advent of small petrol – powered pumps and the ban on the importation of wheat in 1988. As the use of small pumps spreads, conflicts are beginning to emerge between farmers and pastoralists and between small and large scale farmers for land access (Haladu and Bello, 2014).The wetland have also been affected by the construction of dams which has exacerbated the effect of the low rainfall resulting in the reduction in the extent of flooding in the wetlands. Besides, the Hadejia-Nguru Wetlands is also affected by biological invasion as a result of natural and human induced influence which makes many species to invade new regions at an unprecedented rate exerting strong impacts on ecosystems and human welfare (Van Kleunenet. al., 2010).

Similarly, the Nguru wetlands, has been infested by the invasive species known as Typha grass (Typhadomingensis) locally referred to as "Kachala" for many years.Typha grass is suspected to have invaded Nigerian inland wetlands from East Africa (Sabo et. al., 2016). Disturbances such as wildfire, nutrient enrichment (Eutrophication), overgrazing, land use changes, added fertilizer and use of agricultural chemicals enhance the growth of these and other invasive plant species. Other human activities that encourage establishment of invasive species in the wetlands include changes in hydrology e.g. freshwater diversion, constructing ponds, reservoirs and lakes (Westbrooks, 1998). These alter resource availability, creating condition suitable for plant invasion that may have profound effects on native plant community composition with direct and/or indirect influence on local fauna (Hager, 2004). Therefore, bioinvasion is so frequent nowadays in every continent and island that continues to alter and degrade natural wetland habitats (Hager, 2004).They have been considered second major threat to biodiversity following habitat destruction (Elizabeth and Scott, 2000).

"Invasive species" are organisms that spread in space and have negative impacts in the new environment (Alpert et al. 2000). In this way, a species may be non-native but not invasive if it does not negatively impact its new habitat. Likewise, a native species may also become "invasive". Changes in environmental conditions may cause both native and non-native species to become invasive; for example, if there is unusual rainfall or temperature, a non-native mutualist arrives, or through evolution (Alpert et al. 2000). Invasive non-native species are one of the most serious ongoing causes of biodiversity loss and habitat degradation worldwide Pimentel et al. 2000). One reason plant invasion is detrimental to native ecosystem functioning is through lasting alterations to nitrogen (N) and carbon (C) pools. Even after removal, exotic species leave a legacy of ecosystem change (D'Antonio and Meyerson 2002) that can influence vegetation communities. Not all habitats are prone to invasion.

STATEMENT OF THE PROBLEM

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Considerable portion of the Nguru wetlands has been invaded by Typha grass (Typhadomingensis) consequently, most of the communities living along the wetlands are currently embattled with proliferation of Typha grass, which is colonizing most importantly, irrigated lands, ponds, grazing lands, river channels and reservoirs causing blockages and siltation added by the grass (Sabo et. al., 2016). Thus, economic activities on which the local people largely depend on as their sources of livelihoods such as fishing, crop farming, irrigation, livestock farming etc are seriously threatened. According to Yarima, M. (2016), Typha grass invasion significantly affected the socioeconomic status of people whose livelihood depended on wetlands. In his study, he found that there was a significant impact of Typha grass on the livelihood of crop farmers through reduced or complete loss of cultivation of some crops, particularly irrigated crops such as maize, wheat, rice, and vegetable; fish farmers through reduced fishing sites and fish catches as well as livestock farmers through loss of grazing lands.

In their efforts to bring an end to what seems to be a mirage, local communities living along the Nguru wetlands spend a lot of money, time and energy in their quest to control the fast proliferation of Typha grass across the wetlands which invade their farmlands, fishing sites and so on. Different control strategies against the spread of the invasive Typha grass are being employed across the globe to curb the spread and consequent impacts of the cattail such as cutting, burning, flooding, use of chemicals etc.

The Raw Material Research and Development Council (RMRDC) in collaboration with the Yobe state government had developed a technology to briquette the Typha grass of the HNWs into fuel pellets for local use and export using technology from neighbouring Mali. The Federal Ministry of Environment in collaboration with the three states of Yobe, Jigawa and Bauchi embarked on mechanical clearance of the grass in addition to dredging the wetlands all in attempt to curb the spread of this stubborn grass. However, despites these efforts by governments at all levels and of several NGOs, proliferation of Typha grass still persists affecting all ecological aspects of the wetlands and livelihood of the local communities living along the Hadejia – Nguru Wetlands.

In view of the above, this research study was undertaken with the aim of assessing the different control measures employed by the local communities, governments and Non Governmental Organisations(NGOs) in order to combat the proliferation of the invasive Typha grass along the Nguru wetlands in Yobe state, Nigeria.

MATERIALS AND METHODS

The research which studied the socio economic impacts on local communities living along the Nuguru wetlands in Yobe state, Nigeria was conducted in the months of July – August 2017 in three settlements of Nguru, Kakori and DogonKuka all in Nguru Local Government Area.

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Descriptive Survey method of research was used which involved a total of 171 respondents comprising of 159 local people and 12 officials of the Hadejia- Nguru Wetlands Conservation Project (HNWCP) and the KomodouguYobe Basin Wetlands Development Initiative (KYBWI). Researcher made closed ended questionnaire was used to collect quantitative data while Interview Guide was also used to get some qualitative data. All data collected was analyzed using the Frequency, Percentage, Mean and Standard Deviation distribution tables. Respondents were met at different farmlands, irrigation fields, fishing sites and grazing fields and were selected using the Convenient, Snowball and Systematic Random sampling methods.

STUDY AREA

The Nguru Wetlands found in Yobe State Nigeria is a segment of the Hadejia – Nguru Wetlands which lies along a central coordinates of Longitude 100 33' East and Latitude 12o 39' North, with altitude of 152 – 305m. It is an extensive area of floodplain located in the north-eastern Sudano-Sahelian zone of Nigeria, covering an area of approximately 3,500 square kilometer (FAO, 2009). It has an annual rainfall which ranges between 200 – 600 mm, with a rainy season that lasts three to four months, confined to the period late May – September. It comprises of permanent lakes and seasonally flooded pools connected by a network of channels (Birdlife international, 2012).

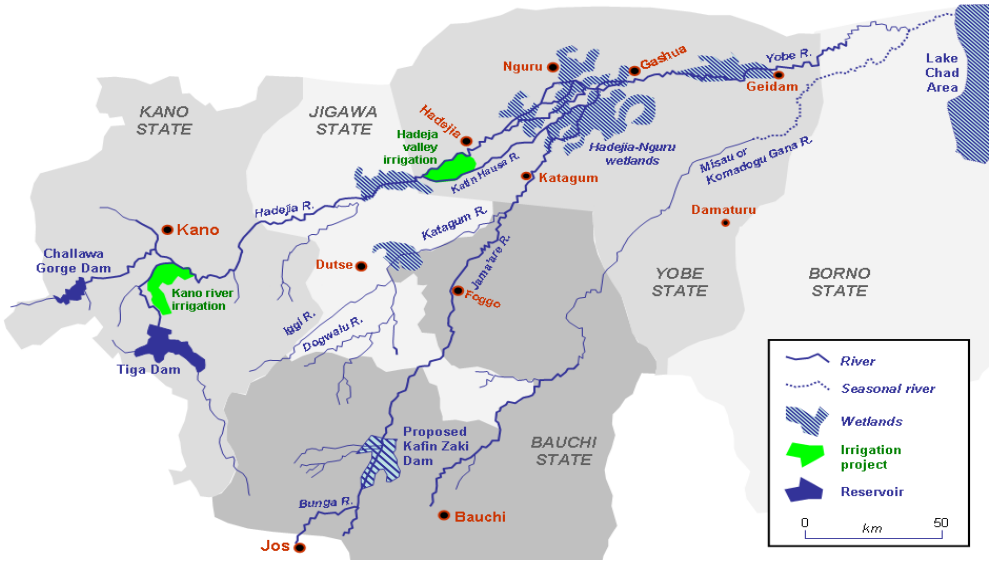

Figure I: Map showing the Nguru wetlands

RESULT ANALYSIS

TABLE 1: Showing control measures according to locals

Control measures of typha grass invasion	**4 (%)**	**3 (%)**	**2 (%)**	**1 (%)**	**Mean**	**Std.**
Local communities spend a lot of time, money and energy in controlling typha grass Invasion	82 (51.57)	77(48.43)	0 (0)	0 (0)	3.52	.501
Cutting,burning and use of chemicals are the most widely used control measures against Typha grass Invasion	42 (26.42	69 (43.4)	33 (20.75	15(9.43)	2.87	.915
All measures used to control Typha grass invasion seem to be Ineffective	56 (35.22)	83 (52.20)	17 (10.69)	3 (1.89)	3.21	.703
Government and other related agencies' efforts in controlling Typha invasion are no enough	72 (40.28)	79 (49.69)	8 (5.03)	0 (0)	3.40	.586
Locals' efforts in controlling Typha invasion affects their productivities	90 (56.60)	66 (41.51)	3 (1.89)	0 (0)	3.57	.497
Majority of the locals cannot afford the control of Typha invasion	122(76.73)	37 (23.27)	0 (0)	0 (0)	3.70	.424
Locals do not get any form of assistance to control Typha invasion	95 (59.75)	64 (40.25)	0 (0)	0 (0)	3.60	.492
To control Typha invasion, locals have to employ the services of others	83 (52.20)	76 (47.80)	0 (0)	0 (0)	3.52	.501
Overall average	**80 (50.47)**	**69 (43.40)**	**8 (5.03)**	**2 91.26)**	**3.42**	**.577**

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Table 2 above shows the response rates of quantitative date gathered from respondents among the local communities with regards to control measures used against Typha grass proliferation in the study location. The overall mean value of 3.42 and std .577 is enough to deduce that the situation is very bad. All the respondents (100%) unanimously agreed that the local communities spend a lot of time, money and energy in their efforts to curb the spread of Typha grass which overtook their farmlands, fishing sites etc where as 69.82% agreed that cutting, burning and use of chemicals were the most widely used control measures by the locals. A total of 87.42% of the respondents also agreed that all the methods used against Typha proliferation seem to be ineffective because the rate of the spread of the grass always overshadows that of the control measures. Almost all of the respondents (100%) also agree that the local farmers could not clear the large biomass of Typha grass that overtook their lands along unless they employ the services of others as a result of which 98.11% of them stated that controlling typha invasion greatly affected their productivities. Besides, 100% of the locals now believe that they cannot fight the spread of typha grass alone and 100% agreed that no support of any sort is given to them by the government.

TABLE 2: Showing control measures according to officials

Control measures of Typhagrass invasion	4 (%)	3 (%)	2 (%)	1 (%)	Mean	Std.
Controlling the spread of Typha affects locals productivity	7(58.33)	2(16.67)	3 (25.0)	0 (0)	3.33	.888
Cutting, burning and use of chemicals are the most widely used control measures	5(41.67)	5 (41.67	2 (16.67)	0 (0)	3.25	.754
Efforts of government and other stakeholders in controlling spread of Typha are not enough	3 (25.0)	6 (25.0)	3 (25.0)	0 (0)	3.25	.754
The rate of Typha proliferation is high despite control efforts	12 (100)	0 (0)	0 (0)	0 (0)	4.00	.000
Efforts to control Typha seem to be ineffective	2(16.67)	3 (25)	7 (58.33)	0 (0)	2.58	.793
Governments and other stakeholders do not support locals financially	3 (25.0)	4(33.33)	5 (41.67)	0 (0)	2.83	.835

Government and other agencies do not give technical support to locals	3 (25.0)	4(33.33)	5 (41.67)	0 (0)	2	. 8	3	.835
Control methods used by government are not appropriate	0 (0)	2(16.67)	6 (50.0)	4 (33.33)	1	. 8	3	.717
OVERALL AVERAGE	**4 (3.33)**	**3 (25.0)**	**4 (33.33)**	**1 (8.33)**	**2**	**. 9**	**8**	**.697**

Table 2 above presents the response rates of the officials of the HNWCP and the KYB-WDI with regards to control measures employed against invasion of Nguru wetlands by the invasive Typha grass. Though considerable number of them 83.33% and 58.33% disagreed with the fact put to them that control measures being used by the government and other agencies were not the appropriate ones and that the strategies being employed were not as effective as expected respectively, majority of them 75.0% and 83.34 did agree that efforts put in by the locals in controlling Typha invasion greatly affected their productivities and that cutting, burning and use of chemicals were the most widely used control methods used against Typha invasion in the area. Besides, 75% of the respondents agreed that efforts put in by government and other related agencies in controlling Typha invasion in the area were not enough while 100% did also agree that the rate of spread of the grass despite all control measures was still very high and unprecedented. Similarly, 58% of the respondents did agree that government and other related agencies do not render any technical or financial support to the local farmers and fishermen.

Qualitative data on control measure of Typha grass

Although it has been captured in the quantitative data that the most widely used control measures against the proliferation of the invasive Typha grass were cutting, burning and the use of chemicals, KIIs from the local communities and the officials of HNWCP and KYB-WDI were interviewed on other management measures being employed against the spread of the grass. They were asked the question that: What other control measures do you take to tackle the spread and socioeconomic impacts of Typha grass in the area?

Their responses to this question were summarized as follows.organisation and sponsorship of communal efforts to clear the grass, organisation of workshops and seminars for the local communities on how to control the spread of Typha grass, participation in mechanical clearance of Typha grass and making available to farmers and fishermen chemicals effective in the control of the grass. Other efforts being made include assisting farmers and fishermen to access loan facilities, provision of improved methods of farming amidst Typha invasion, provision of water pumps to boost irrigation farming as well as provision of clinical services and advises on how to treat animal diseases. The local people also stated that they sometimes flood the area to avoid seed germination.

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Meanwhile, the KIIs at the two Organisations(NHWCP and KYB-WDI) were also asked this question: "what challenges do you encounter in the implementation of these measures?

The responses were summarised as follows: Lack of cooperation on the side of the local communities, people's illiteracy affects the success of the measures, lukewarm attitude of government, widespread corruption and insufficient funding are some of the major challenges being faced

Another question put forward to KIIs at the two agencies was:How do you assess the effectiveness of the common management/control measures used in controlling Typha invasion in the area? Responses to this question were summarised as follows:

Most of the control methods used are effective except that the rate of spread and invasion of Typha grass is beyond human imagination. Besides, it was as well gathered that chemical control method proves to be the most effective method except that it is very expensive that the local communities cannot afford it. Similarly, improper use of the chemicals as a result of people's illiteracy as well as lack of efficient modern tools and equipments also affects the effectiveness of the management measures. Furthermore, it was also gathered that majority of the local communities have a belief that fully matured Typha grass is home to evil spirits hence, they do not clear it out of fear of spirit attacks.

DISCUSSIONS

Typha control can be difficult where cattails have formed large monocultures and dense rhizomal systems, which allows them to grow back quickly. Methods for control include chemical control such as herbicide application, physical removal such as cutting or pulling, physical damage such as disking, or crushing, prescribed burning, grazing, shading, water level manipulations, salinity alterations, biological controls and soil impoverishment. However management is achieved, the effects can be short-lived and have often resulted in more vigorous growth in the long term especially if not all Typha are killed, and nutrient availability is high. Additional management such as water level manipulation after cutting to drown stems or planting/seeding of native species in areas where seed banks have been diminished may be needed if initial efforts fail to eliminate invasive species entirely (Kathryn, 2013).

Generally, the study was able to find out that the situation with respect to control of typha invasion was very bad. It was discovered that the local communities spend a lot of time, money and energy in their efforts to curb the spread of typha grass which overtook their farmlands, fishing sites etc and cutting, burning and use of chemicals were the most widely used control measures by the locals.These findings agree with that of Yarima (2016) who stated that to control the proliferation of Typha grass along the Hadejia-Nguru wetlands, majority of the farmers (56%) employ method of cutting while about 36% of the farmers use mechanical clearing method by slashing the weed while about 9% use chemical method as a strategy to

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reduce the weed. According to Temitope (2012), mechanical control is labour-intensive and thus expensive to use in extensive and dense infestations, or in remote or rugged areas. In Nigeria, mechanical control of water hyacinth was estimated to cost US$ 639 per hectare. (Kasulo, 2000). It costs the Zambian government approximately US$ 450 000 to clear 900 hectares of 3,000 hectares of Mimosa pigra L. infestation on the Kafue Flats. The costs of clearing condensed stands of invasive Prosopis species, Chromolaenaand Lantana in riparian vegetation in South Africa between 1997/98 and 2005/6 was about US$310, US$ 380 and US$ 380 per hectare, respectively (Marais and Wannenburgh 2008).

In addition, it was also revealed that methods used against typha grass proliferation seem to be ineffective because the rate of growth and spread of the grass always overshadows that of the control measures. This finding further confirms many other studies which revealed the ability of typha grass to grow and spread very fast. This could be attributed to the very adaptive biology of the grass. The grass colonizes the area very quickly due to the wide and efficient dispersal of its seeds by wind and water movement (Akinsola, 2000). Besides, the grass produces numerous microscopic seeds that are easily dispersed by wind to many places thereby increasing its ability to invade many areas. Another finding was that, the local farmers could not clear the large biomass of typha grass that overtook their lands alone unless they employ the services of others as a result of which according to them, controlling Typha invasion greatly affected their productivity. To some of the local people, invasion of the wetlands by typha grass was a blessing because they depend on clearingtypha grass from lands and fields as a source of livelihood. According to them, they make very good amount of money out of the business.

In addition to mechanical method of controlling typha invasion such as cutting, it was also found out that the local communities do employ the use of chemicals and fires as well as flooding the area as other control strategies. According to Deborah (1993), typha has been controlled by a number of herbicides including 2, 4-D, Monuron, MCPA, TCA, Amitrole,Diuron, 2, 2-DPA, Terbutryn, Tandex. Dalapon and Glyphosate are the most widely recommended herbicides for the control of typha grass. According to Yarima (2016), to control the proliferation of Typha grass along the Hadejia-Nguru wetlands, about 9% of the farmers use chemical method as a strategy to reduce the weed. Herbicides can be applied to prevent sprouting of cut stumps, or to kill seedlings after felling or burning. Herbicides can target, for example, grasses or broad-leaved species, leaving other plants unharmed. However, there are legitimate concerns over the use of herbicides in terms of potential environmental impacts. Although newer herbicides tend to be less toxic, have shorter residence times, and are more specific, concerns over detrimental environmental impacts still remain (Deborah, 1993).The use of chemical control is often governed by legislation, and the effective and safe use of herbicides requires a relatively high level of training; both of these factors can restrict the use of chemical control on a large scale. Many invasive plants have been kept at acceptable levels by herbicides. For instance, in Florida, water hyacinth was drastically reduced and subsequently managed by use of the herbicide 2,4-D, combined with some mechanical removal (Schardt 1997). Glyphosate is also another herbicide widely used for controlling invasive species globally. This is because it is a relatively non-toxic chemical that does not persist in the environment. Care must be taken during application to

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minimize effects to surrounding desirable vegetation. However, herbicide application in a large piece of land taken over by invasive species can be very expensive.

Meanwhile, the local farmers did also state that they sometimes flood the area (Lake draw-down) to prevent sprouting of new typha plants as a way of controlling its growth. Although this method is very effective and less environmentally risky over the use of herbicides, its use in large piece of land invaded by typha grass could be very difficult and beyond the abilities of the local communities. Cook (1980) reviewed the use of Lake draw-down as a macrophyte control technique and concluded that the technique can be effective, but is species specific, because some species are resistance to over flood. These indicated that if the rhizome is over flooded there are all tendencies for the plant to die. This strategy is less costly compare to chemical considering the risk and damage to the environment.

Going by the findings of this study, efforts of governments and other related agencies towards the control of typha grass invasion in the study area was not enough. However, it was discovered that recently, the Federal Government of Nigeria through the Federal Ministry of Environment had embarked on operations to clear typha grass along the Nguru wetlands using mechanical means where by typha grass has been cut using machines specially meant for that. In a similar study conducted by Sabo et al., (2016) along the Hadejia-Nguruwetands, he found out that the Jigawa State government did some mechanical excavation work and also construct large sand embankments to protect the communities against flood. The communities also mentioned that, local Governments give them assistance in the form of bags used for dyke construction. There is also the presence of some Non-Governmental Organizations (NGO's) in thearea. These NGO's helps in channel clearance, raise awareness for the people to engage in communal efforts and also funds some proposals by the communities. Some of these NGO's operating in the area include; Jigawa Wetlands Project (JWL), Nigeria Conservation Foundation (NCF), Hadejia – Nguru Wetlands Conservation Project (HNWCP), Coalition for Change C4C (a DFID project), IUCN ROCA, LCBC/GEF project, Ramsar Swiss Grant and KomaduguYobe Basin Development Initiative (KYB-WDI). Moreover, there is also the presence of some Government agencies in the area, these include; Federal Ministry of Water Resources, HadejiaJama'are river Basin Development Authority, Federal and State Integrated Water Resources Management Committees and Jigawa State Ministry of Environment. Right now the Federal Government of Nigeria is clearing the channels using machines.

With regards to findings made at the two agencies visited, both government and other NGOs present at the wetlands do carryout some control efforts however, some challenges were threatening the success of these efforts. According to the officials of these agencies, these challenges include: Lack of cooperation on the side of the local communities, the local people's illiteracy, and lukewarm attitude of government, widespread corruption and insufficient funding are some of the major challenges being faced.

CONCLUSION

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In conclusion, this research study was able to reveal that the efforts of government and other related agencies such as the NGOs present at the area for example the Hadejia-Nguru Wetlands Conservation Project (HNWCP), Nigeria Conservation Foundation (NCF), KomodouguYobe Basin Wetlands Development Initiative (KYB-WDI) etc are not enough so, the task ofclearing typha grass by the local communities is biting hard on them and really affects their productivity. However, it was gathered that, the Federal Government of Nigeria had recently embarked on mechanical clearance of the grass from the wetlands. Some of the non governmental agencies did claim to support clearing of the grass in terms of organizing communal efforts, provision of herbicides to kill the grass, provision of water pumps to boost farmers' productivity, loan facilities accessible to farmers and so on. Manual cutting using sickles and cutlasses, fires and use of chemicals were found to be the most widely control methods used by the local communities to stop the spread of typha grass most of the times employing services from other people.Lake draw-downs (flooding) method was also used as a control measure by the locals. However, despite all efforts to curbtypha invasion of the wetlands, the rate of typha proliferation is still very high and is on the increase. It was also discovered that the local communities do not receive any form of assistance towards combating the menace of typha grass invasion from the government or any other agency however, officials of the HNWCP and the KYB-WDI stated that many NGOs do participate in mechanical clearance of the grass in order to stop its spread.

Meanwhile, it was as well found out that, the effectiveness of typha grass control measures were being hindered by some factors.Most of the control methods used were effective except that the rate of spread and invasion of Typha grass is beyond human imagination. Chemical control method using herbicides proved to be the most effective method except that it is very expensive that the local communities cannot afford it. Similarly, improper use of the chemicals as a result of people's illiteracy as well as lack of efficient modern tools and equipments also affects effectiveness of the management measures. Furthermore, it was also gathered that majority of the local communities have a belief that fully matured typha grass harbour evils spirits hence, do not usually clear it out of fear of spirits attack.

The study also revealed that challenges faced by agencies supporting the control of typha grass invasion along the wetlands include: Lack of cooperation on the side of the local communities, people's illiteracy lukewarm attitude of government, widespread corruption and insufficient funding.

REOCMMENDATIONS

From the foregoing, it could be deduced that the management of invasive species is taking another dimension and is not business as usual. Its impacts affect all aspects of human life affecting the environment, health, social as well as economic status. Based on the findings made by this study, the following recommendations are thereby proffered:

1.Though typha control can be difficult where cattails have formed large monocultures and dense rhizomal systems, which allows them to grow back quickly, proper application of control measures such as mechanical clearance, Lake draw-down and fires could help. However, through

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the adoption of chemical and biological control methods which are already in use in other countries and have proved to be effective, the menace of typha invasion along Nguru wetlands can be eradicated. Dalapon and Glyphosate are herbicides widely used for controlling invasive species globally. This is because it is a relatively non-toxic chemical that does not persist in the environment. Other herbicides also used are 2, 4-D, Monuron, MCPA, TCA, Amitrole, Diuron, 2, 2-DPA, Terbutryn and Tandex.

2. Biological control, instead of eliminating the target organismaims at establishing an equilibrium which maintains its population at a level of negligible harm (Bani 2002). It has been practiced for many decades by a host of countries, especially the USA, Australia, South Africa, Canada, and New Zealand. In the past 150 years, until the end of 1996, more than 350 species of invertebrates and pathogens were deliberately released in 75 countries for the control of at least 133 weed species (Julien and Griffiths 1998). The grass carp or white amur (Ctenopharyngodonidella Val) which has some potential for biological control of typha grass can also be used. Deborah (1993) made a list of insects which parasitise Typha. These include many species of Lepidoptera and Hemiptera which damage the inflorescence while feeding. Larvae ofCalendrapertinax are stem borers and also feed on the starchy cortex of the rhizomes. Also, entire stands of typhawere eliminated after being colonised by boring moth larvae (Arzana spp.).

3.Governments in Nigeria should come up with policies on how to convert process and recycletypha grass into positive uses such as fuel source, building materials, feed for animals, furniture e.g. mats, household usages such as baskets etc.

4.Local communities should be empowered to control typha grass proliferation through the provision of proper tools, herbicides, funds etc.

5.Federal Government of Nigeria should reintroduction of the North East Arid Zone Development Programme (NEAZDP), an EU assisted project that was present in the area some years back. NEAZDP helped greatly towards the eradication of typha grass from the Hadejia-Nguru wetlands and assisted farmers in many respects with the aim of enhancing their activities and boosting their productivity.

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