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Occurrence and Spatial Distribution of Terrestrial and Aquatic Invasive Alien Plants in Lafia, Nigeria

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Abstract
There is paucity of information on the occurrence, distribution and ecological impacts of invasive alien plants (IAPs) in sub-Saharan Africa in which Nigeria is part of. Therefore, this study qualitatively assessed the occurrence and spatial distribution of terrestrial and aquatic IAPs in Lafia, Nigeria, to document them for conservation and management purposes. Purposeful and opportunistic sampling method were employed for this descriptive study. At each of the sections of the study area, the wetlands found there will be observed for the occurrence of any IAPs. Terrestrial habitats with visual observation of the occurrence of any IAPs were selected for the study. Plant species with more than 80% percentage cover of the entire vegetation population were considered as potentially invasive. The identity and relative abundance of the IAPs were documented for each invaded site. Their occurrence and spatial distribution maps were also produced. At the study sites, 19 terrestrial IAPs belonging to 10 families and 14 aquatic IAPs belonging to 10 families were identified. Their relative abundance ranges between very abundant and abundant across all the invaded sites. Most of the aquatic habitats containing the IAPs were found to be streams whereas terrestrial invasive plants were mostly observed along the roadside as compared with other land use types. More control and management priority should be focused on these terrestrial (*Sida acuta* and *Hypti suaveolens*) and aquatic (*Eichhornia crassipes* and *Ipomoea aquatica*) IAPs due to their wide spatial distributions across the urban areas of Lafia, Nigeria.

Keywords: Conservation, *Hyptis Suaveolens*, Invasive Plants, Lafia, Terrestrial

Introduction

Invasive plants, also known as alien, non-native, or exotic plants, are species that have been introduced to an area outside their native range and have the ability to spread rapidly, outcompete native vegetation, and negatively impact ecosystems. These plants can cause significant ecological and economic damage by altering natural habitats, reducing biodiversity, and disrupting ecosystem processes (Chad, 2009). As global connectivity and reach continues to rise, it is important to understand the ecological impacts of non-native species invasions and the mechanisms that facilitate their arrival, establishment, and spread. The colonization of non-native flora and fauna has become very common over the last century and with a warming climate the threat of invasion is projected to increase (Richardson & Rejmánek, 2011). Changing land-use patterns and increases in human development and modifications will facilitate the colonization of invasive plants in New Hampshire, with the potential for a northward expansion as new areas become suitable (Allen et al., 2013). Invasive plant species often outcompete native plants for resources and space through a suite of mechanisms including increased uptake of resources, differential timing of resource use, and habitat alterations to benefit the invader (Levine et al., 2003; Vila & Weiner, 2004; Richardson et al., 2007; Vilà et al., 2011). Colonization by invasive plants can have many direct and indirect impacts to ecosystem functioning, habitat physical structure, population dynamics, native species composition, and species richness (Levine et al., 2003; Vila & Weiner, 2004).

While the ecological impacts of invasive plants are well-documented in many parts of the world, there is paucity of information on the occurrence, distribution and impacts in sub-Saharan Africa in which Nigeria is part of. Invasive plants can have complex interactions with native species, altering community dynamics, nutrient cycling, and habitat structure. The assessment of their occurrence and distribution coupled with their potential ecological impacts is necessary to ensure a comprehensive evaluation of the consequences of invasive plants on ecosystems. These invasive plants tend to affect the aquatic ecosystems by obstructing the flow of water and

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accumulation of nutrients thereby leading to secondary succession. There have been visual observations of these invasive plants in some of the aquatic and terrestrial habitats in Lafia. However, they have not been documented for conservation and management purposes. This study therefore focuses on bridging the gap in the knowledge of occurrence and spatial distribution of terrestrial and aquatic invasive plants in a guinea savanna ecosystem of Nigeria in order to develop effective management strategies and conservation measures. Hence, the objectives of this study are to identify and document the occurrence and relative abundance of terrestrial and aquatic invasive plant species and to map their distributional patterns in Lafia, Nasarawa State.

Materials and Methods

Study Area

This study was carried out within Lafia. For easier sampling and adequate geographical spread, Lafia was divided into different sections namely east, north, central, west and south. Sampling sites were then located at each of these sections for the study (Figure 1).

Sampling Techniques

Purposeful and opportunistic sampling method was employed for this descriptive study. Sites with visual observation of the occurrence of any invasive plants were selected for the study. Where present, the geographical coordinates of the sites were then recorded using a GPS device. Thereafter, the identity of the invasive plant was determined on the field or samples taken to the herbarium for proper identification. The abundance of the invasive plants in each site was determined following the methods of Bongers et al. (1988) and Kayode (1999) as: Less than 5 individuals as rare, 5 to 10 as occasional, 11 to 30 as frequent, 31 to 100 as abundant and over 100 individuals as very abundant. The land use of the sites where the invasive plants are found was also documented. The type of the wetlands where the IAP are found was determined and categorized based on source of water supply, natural or artificial, and flow of water. The life forms of the IAPs were also determined whether they are emergent, free-floating or submerged.

Spatial distribution mapping of IAPs

The occurrence and distribution map of the invasive plants in Lafia was produced using the geographical coordinates of the occurrence of the IAPs in the wetlands. This was achieved with the aid of the ArcGIS 10.8 software.

Results

Occurrence and Relative Abundance of Terrestrial and Aquatic Invasive Plants

A total of eleven (11) locations were sampled for the presence of terrestrial invasive plants in Lafia metropolis. At these sites, nineteen (19) terrestrial invasive plants were identified (Table 1). These invasive plants exhibited different abundance statuses and distributions across the entire study area. Their relative abundance ranges between very abundant and abundant in the locations where they are found. FULafia permanent site was observed to be the only site with the highest number of terrestrial invasive plant species. This site had four terrestrial invasive plants that were found to be very abundant. The plants include, *Hyptis suaveolens, Urena lobata, Sida acuta*, and *Senna tora.* Other sites were found to have only one or two occurrences of terrestrial invasive species. All the terrestrial invasive plants are distributed across ten families with Fabaceae having the highest number of species (Table 2). Lamiaceae also followed Fabaceae in the number of species which is three. The invasion status of the plants showed that all of them have been earlier reported and confirmed to be invasive in online invasive plants database.

A total of fourteen (14) aquatic invasive plant species belonging to fourteen (14) families were observed in all the fourteen (14) locations visited in Lafia (Table 3). The aquatic invasive species include *Acalypha* (Euphorbiaceae) *Dichanthelius clandestinum* (Dryopteridaceae), *Eichhornia crassipes* (Pontederiaceae), *Ipomoaea aquatica* (Convolvulaceae), *Nymphae lotus* (Nymphaeceae), *Panicum clandestinum* (Poaceae) *Panicum dichotomiflorum* (Poaceae) *Setaria italica* (Poaceae), *Ipomoea pas-caprae* (Convolvulaceae), *Crinum americanum* (Amaryllidaceae), and *Thalia ganiculata* (Amarantaceae). Two invasive species were classified as floating including *Eichhornia crassipes* and *Nymphaea lotus.* The result shows that majority of the aquatic invasive species in all the study sites are emergent in life forms (Table 4).

The assessment of the occurrence and distribution of terrestrial and aquatic invasive plants in Lafia, Nasarawa State, has significant implications for the local environment and biodiversity. Invasive plants, as observed in this study have the potential to disrupt native ecosystems, alter soil composition and seed banks (Akomolafe et al., 2024), and threaten the survival of indigenous flora and fauna. The occurrence of these invasive plants signifies a diverse range of invasive species with varied ecological impacts. For instance, Kudzu (*Pueraria montana*) is notorious for its rapid vine growth, which could lead to the smothering of native vegetation. Such invasive characteristics alter the landscape and disrupt the natural balance of ecosystems. Other previous studies have also

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reported some of these invasive plants in other locations within Nasarawa State (Akomolafe & Rahmad, 2020; Akomolafe & Rosazlina, 2023). The spread of the aquatic invasive plants may also impact water resources, as seen in the case of Blue Waterleaf (*Hydrolea ovata*), which spreads in wetland areas. They may also be agents of secondary succession through obstruction of normal flow of water and accumulation of sands (Akomolafe & Rahmad, 2020). These invasive plants could also impose threats to the economy of the local dwellers who have relied on the water from the wetlands for their survival.

Spatial distribution of Terrestrial and Aquatic Invasive Plants

The spatial distribution of the terrestrial invasive plants and the nature of the land use of areas invaded in Lafia are shown in Figure 2 below. The terrestrial invasive plants in Lafia are distributed across four main land use types which include abandoned area, dumpsite, farmland and roadside. The roadside represented by green colour was observed to have the highest spatial distribution of the land use of occurrence of terrestrial invasive plants in the study area. This is followed by the farmland represented by yellow colour. Out of all the terrestrial invasive plants observed in Lafia, *Sida acuta* and *Hypti suaveolens* are the most spatially distributed ones. Also, it was observed that the spatial distribution of the terrestrial invasive plants were focused at the urban center of Lafia city.

Figure 3 shows the spatial distribution of the locations of study and the categories of wetland observed for the presence of aquatic invasive alien plants in Lafia town. It was observed that streams were most widely spread across the study areas than the ponds. A total of 14 locations were sampled of which 12 locations are streams which includes Agyaragu, Akunza migili, Bukan kwoto, Doma, Gandu 2, Kwandere, opposite tripple zee farm, Shabu 1, Shabu 2, Shabu 3, wakwa1 and wakwa2 (2) while Gandun 1, Mararaba Akunza are ponds. The spatial distribution of the most abundant and widely spread aquatic invasive alien plants in Lafia is shown in Figure 4. *Eichhornia crassipes* and *Ipomoea aquatica* were the most widely spread aquatic invasive alien plants in this study.

Wandell and Wolfson (2007) reported that the fertility of wetlands and its amount of aquatic plant is greatly influenced by a number of factors such as its watershed characteristics and sizes, drainage patterns and land use. It was also reported in Davies et al. (2009), that the productivity of wetland is a function of the amounts of plankton and invasive species it contains as they are the main primary producers. This indicates that all the wetlands sampled in Lafia are all productive because they all have at least one population of invasive species. Previous work done by Chowdhury and Ahmed (2012) also stated that the physiochemical condition of habitats such as presence of high salinity usually limit the occurrence of invasive species in wetlands. Therefore, some of the sampled wetlands in Lafia with the absence or low abundance of invasive species could be as a result of unfavourable physiochemical conditions of such wetlands.

Conclusion

The assessment of the occurrence and distribution of terrestrial and aquatic invasive plants in Lafia, Nasarawa State, has provided valuable insights into the current status of these problematic plants in terms of their abundance, diversity, ecological distribution and potential challenges faced by the local environment. The presence of a diverse array of these terrestrial and aquatic invasive species, including but not limited to *Hyptis suaveolens, Sida acuta, Pueraria montana*, and *Chromolaena odorata*, indicates the need for strategic and informed conservation and management efforts in Lafia.

References

Akomolafe, G. F., & Rahmad, Z. B. (2020). Wetlands invaded by Pneumatopteris afra (Christ.) Holttum are less diverse and more threatened than non-invaded ones in Nigeria. *Songklanakarin Journal of Science & Technology*, *42*(4), 858-864.

Akomolafe, G. F., & Rosazlina, R. (2023). Evidence of invasion: Land use influences the invasion of Urena lobata in the Guinea Savanna ecosystems of Nigeria. *Biological Invasions*, *25*(7), 2175-2184.

Akomolafe, G. F., Rosazlina, R., & Omomoh, B. (2024). Soil seed bank dynamics of two invasive alien plants in Nigeria: implications for ecosystem restoration. *AoB Plants*, *16*(2), 1-9.

Allen, J. M., Leininger, T. J., Hurd, J. D., Jr. Civco, D. L., Gelfand, A. E., & Silander, J. A., Jr. (2013). Socioeconomics drive woody invasive plant richness in New England, USA through forest fragmentation. *Landscape Ecology*, 1671–1686.

Bongers, F., Popma, J., Meave del Castillo, J., & Carabias, J. (1988). Structure and floristic composition of the lowland rainforest of Los Tuxtlos, Mexico. *Vegetation, 74*, 55-80.

Chad, F. H. (2009). The impacts of terrestrial invasive plants on streams and natural and restored riparian forests in northern new England. *University of New Hampshire*, Pp. 1-92.

Chowdhury, A. H., & Ahmed, R. (2012). Water, Sediment and Macrophyte quality of some Shrimp Culture ponds and freshwater ecosystems of Koyra, *Bangladesh Journal of Botany 1*, 35-41.

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Davies, O. A., Abawei, J. F. N., & Tawari, C. C. (2009). Phytopankton community of elech creek, Niger-Delta, Nigeria. A nutrient polluted tropical creek. *America Journal of Applied Sciences*, *6*(6), 1143-1152.

Kayode, J. (1999). Phytosociological investigation of compositae weeds in abandoned farmlands in Ekiti State, Nigeria. *Compositae Newsletter, 34*, 62-68.

Levine, J. M., & D'Antonio, C. M. D. (2003). Forecasting biological invasions with increasing international trade. *Conservation Biology*, *17*, 322-326

Richardson, D. J., & Rejmánek, M. (2011). Trees and shrubs as invasive alien species a global review. *Diversity and Distributions*, *5*(17), 788-809.

Richardson, D. M., Holmes, P. M., Esler, K. J., Galatowitsch, S. M., Stromberg, J. C., Kirkman, S. P., Pyšek, P & Hobbs, R. J. (2007). Riparian vegetation: Degradation, alien plant invasions, and restoration prospectives. *Diversity Distribution*, *13*, 126–139.

Vila, M., & Weiner, J. (2004). Are invasive plant species better competitors than native plant species? Evidence from pairwise experiments. *Oikos, 105*, 229–238. doi:10.1111/j.0030- 1299.2004.12682.

Vilà, M., Espinar, J. L., Hejda, M., Hulme, P. E., Jarošík, V., Maron, J. L., & Pyšek, P. (2011). Ecological impacts of invasive alien plants: A meta-analysis of their effects on species, communities and ecosystems. *Ecology Letters, 14*(7), 702-708.

Wandell, H. D., & Wolfson, L. G. (2007). *A citizen's guide for the identification, mapping and management of the common rooted aquatic plants of michigan lakes, in partnership with michigan lake and stream associations,* Inc. 2nd edition. Pp 200

Cite this article as:
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Table 1: Occurrence and Relative Abundance of Terrestrial Invasive Plants at Different Locations in Lafia

S/N	Species	Location/occurrence										
		FULafia	Shabu 1	Shabu 2	Kwandare	Doma road	Agyaragu	Gimare	Wamkwa	Sabon Garin	Phase 2	Mararaba
1	*Hyptis suaveolens*	VA	X	X	X	X	X	X	X	X	X	X
2	*Sida acuta*	VA	VA	X	VA	X	X	VA	X	X	X	X
3	*Senna tora*	VA	X	X	VA	X	X	X	X	X	X	X
4	*Urena lobata*	VA	X	X	X	VA	X	X	X	X	X	X
5	*Mesophaerum suaveolens*	X	VA	X	X	X	A	X	X	X	X	X
6	*Pueraria montana*	X	VA	X	X	X	X	X	X	X	X	X
7	*Ipomoea pes-carpe*	X	X	A	X	X	X	X	X	X	X	X
8	*Senna occidentalis*	X	X	X	VA	X	X	X	X	X	X	X
9	*Datura stramonium*	X	X	X	X	VA	X	X	X	X	X	X
10	*Luffa aegyptiaca*	X	X	X	X	VA	X	X	X	X	X	X
11	*Chromolaena odorata*	X	X	X	X	X	A	X	X	X	X	X
12	*Ipomoea triloba*	X	X	X	X	X	X	VA	X	X	X	X
13	*Mitracarpus hirtus*	X	X	X	X	X	X	X	A	X	X	X
14	*Hydrolea ovata*	X	X	X	X	X	X	X	A	X	X	X
15	*Commelina benghalensis*	X	X	X	X	X	X	X	A	X	X	X
16	*Aeschynomene americana*	X	X	X	X	X	X	X	X	A	X	X
17	*Trichisanthes kirilowii*	X	X	X	X	X	X	X	X	X	A	X
18	*Elsholtzia ciliata*	X	X	X	X	X	X	X	X	X	A	X
19	*Tithonia diversifolia*	X	X	X	X	X	X	X	X	X	X	VA

KEY: Very Abundant = VA, Abundant = A, Absent = X

Table 2: Invasive status of the plants observed at various locations in Lafia

Key: Invasive = +, Non-invasive = --

S/N	Scientific name	Common name	Family	Invasive Status
1	*Hyptis suaveolens*	Curry leaf	Lamiaceae	+
2	*Sida acuta*	Common wirewood	Malvaceae	+
3	*Senna tora*	Sickle senna	Fabaceae	+
4	*Urena lobata*	Caesarweed	Malvaceae	+
5	*Mesophaerum suaveolens*	Pignut	Lamiaceae	+
6	*Pueraria montana*	Kudzu bean	Fabaceae	+
7	*Ipomoea pes-carpe*	Beach morning glory	Convolvulaceae	+
8	*Senna occidentalis*	Coffee senna or Nigerian senna	Fabaceae	+
9	*Datura stramonium*	Thorn apple	Solanaceae	+
10	*Luffa aegyptiaca*	Sponge gourd	Cucurbitaceae	+
11	*Chromolaena odorata*	Christmas bush or Devil weed	Asteraceae	+
12	*Ipomoea triloba*	Little bell or Aiea morning glory	Convulvulaceae	+
13	*Mitracarpus hirtus*	Tropical girdlepod	Rubiaceae	+
14	*Hydrolea ovata*	Blue waterleaf	Hydroleaceae	+
15	*Commelina benghalensis*	Tropical spiderwort	Commelinaceae	+
16	*Aeschynomene americana*	American joint vetch	Fabaceae	+
17	*Trichisanthes kirilowii*	Chinese cucumber	Cucurbitaceae	+
18	*Elsholtzia ciliata*	Vietnamese balm	Lamiaceae	+
19	*Tithonia diversifolia*	Mexican sunflower	Asteraceae	+

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Table 3: Occurrence and Relative Abundance of Aquatic Invasive Species

S/N	Scientific name	Site1 GAN 1	Site2 GAN 2	Site 3 MAB	OTF	Site 5 SHB1	Site 6 SHB 2	Site 7 WAK	Site8 WAK 2	Site9 KWAN	Site10 BUK	Site11 AGY	Site12 A/Migi l	Site13 DM	Site14 SHB 3
1	*Eichhornia crassipes*	VA	X	X	X	VA	X	X	X	X	X	VA	X	0	VA
2	*Ipomoea aquatica*	VA	X	X	X	VA	X	X	X	VA	X	X	X	X	X
3	*Nymphae lotus*	VA	X	X	X	X	X	0	X	X	X	VA	X	X	VA
4	*Dryopteris filis-mas*	X	X	X	X	VA	VA	X	X	X	VA		X	X	X
5	*Panicum clandestinum*	X	X	X	VA	X	X	VA	X	X	X	VA	X	F	X
6	*Dichanthelium clandestinum*	X	X	VA	X	X	X	X	X	X	X	X	VA	X	X
7	*Ipomoea aquatic forsk*	X	VA	VA	X	X	X	X	X	X	X	VA	X	X	X
8	*Acalypha australis*	X	X	X	X	X	X	VA	VA	X	X	0	X	X	X
9	*Setaria italica*	X	X	R	X	X	X	X	VA	X	VA	X	X	X	X
10	*Phalaris arundinance*	X	X	X	X	VA	VA	X	X	VA	X	X	X	X	X
11	*Crinum americanum*	X	X	VA	X	X	X	X	X	X	X	VA	X	X	X
12	*Ipomoea pas-caprae*	X	X	X	X	VA	VA	X	X	X	VA	VA	X	X	X
13	*Thalia geniculata*	X	X	X	X	VA	VA	X	X	VA	X	VA	X	X	X
14	*Xanthosoma sagitolium*	X	X	X	X	F	F	X	X	X	X	VA	X	X	X

Key: VA – very abundant, O – Occasional, R-Rare, F-frequent, x – absent

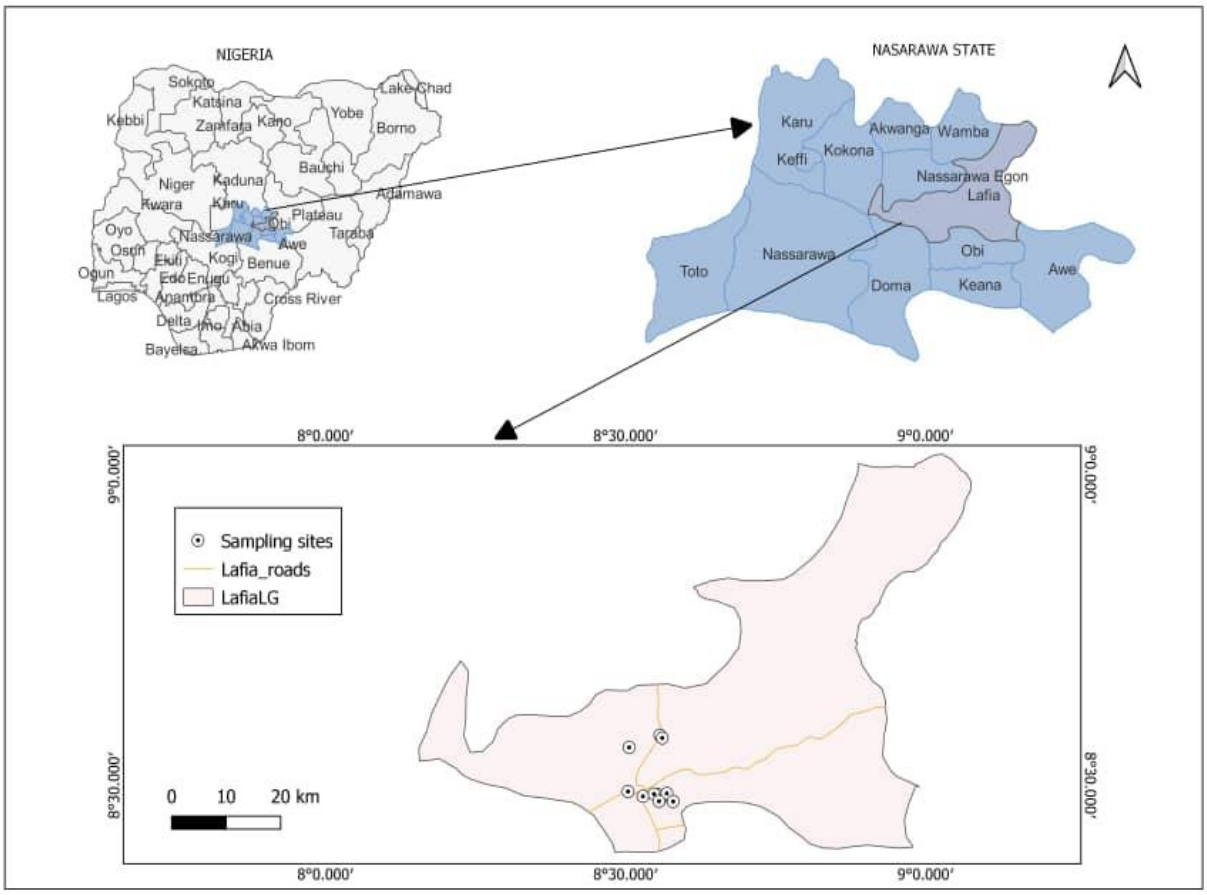

Figure 1: Study area map of Lafia, Nasarawa State, Nigeria

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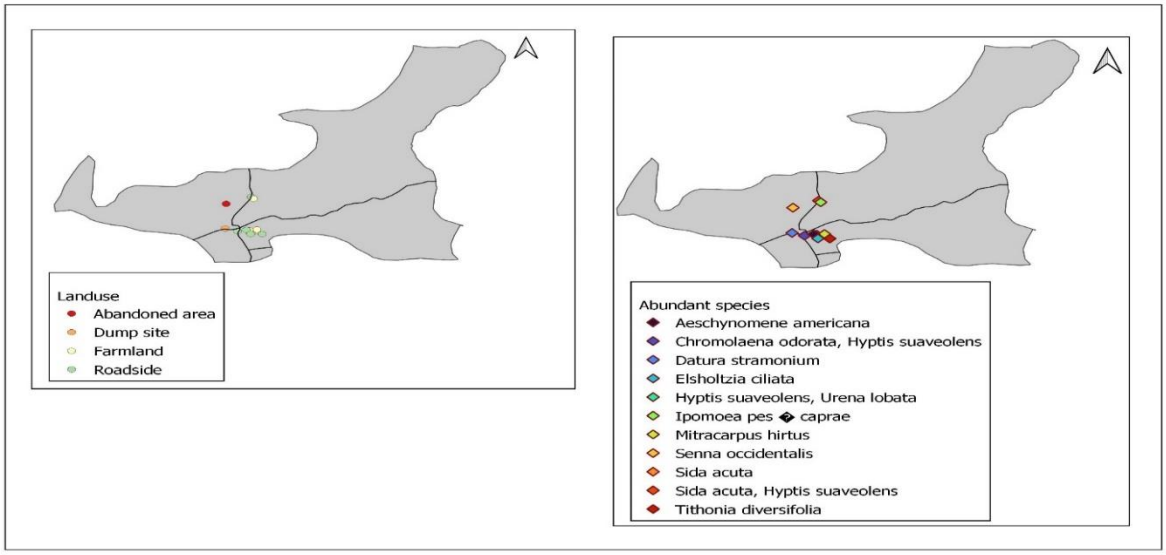

Figure 2: Map showing the spatial distribution of the terrestrial invasive plants in the study area.

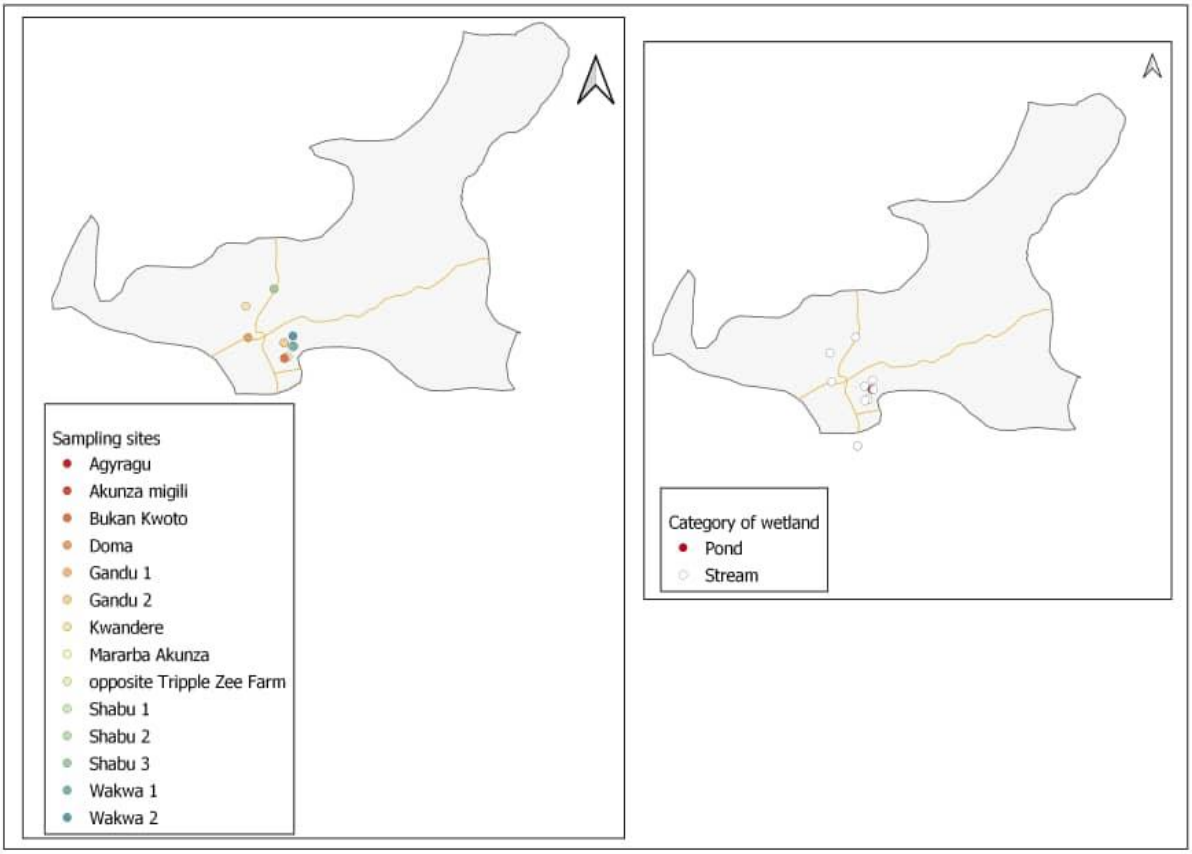

Figure 3: The spatial distribution of the locations of study and the categories of wetland

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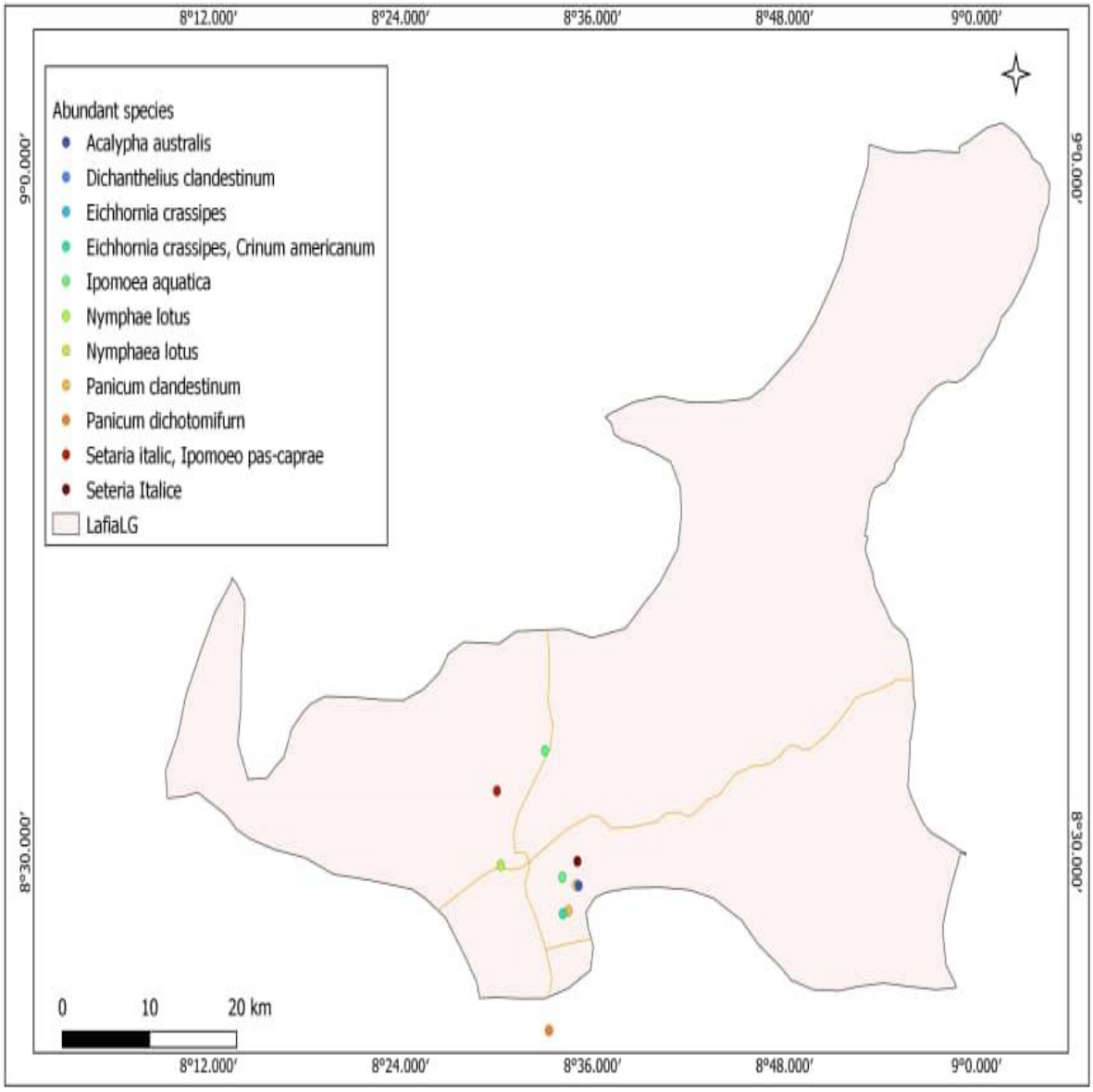

Figure 4: The spatial distribution of the abundant aquatic invasive plants in the study area

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