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Prevalence of Invasive Plant Species, Its Effects on Biodiversity Conservation, Challenges and Opportunities for Management in Africa: A Review

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ABSTRACT
Invasive alien plant species are identified as plants that have been purposefully or unintentionally introduced to areas outside of their natural habitat. Invasive Plant Species (IPSs) are one of the biggest risks to ecosystem function and world biodiversity. In Africa, invasive plant species are a source of concern, as they can displace native flora and fauna, alter ecosystem structure and function, and threaten the livelihoods of millions of people who rely on natural resources for their survival. Conservation is essential to preserve Africa's unique biodiversity and guarantee the sustainable use of its natural resources. An analysis of the various literature is necessary to understand the presence of invasive plant species in Africa, their effects on conservation efforts, and to identify relevant information gaps. We reviewed 113 articles published from 2000 to 2023 covering the invasiveness of plants in different African countries, their effects, and ways to manage and conserve biodiversity. IPSs once established can spread rapidly and outcompete native plant species, leading to significant changes in the composition and structure of ecosystems. Different methods have been employed in the management and control of IPSs, which include the use of chemicals, mechanical and biological control. This paper reviewed the challenges and opportunities in managing invasive species in Africa and came up with recommendations and calls to action for effective management and control of invasive species. Preventing the introduction of new and potentially invasive taxa is a critical component of any IPSs management approach. A large number of African countries lack policies and regulations to prevent and control IPSs, this is a call for immediate action to be taken. Utilization of IPSs is also highly recommended for African countries that are yet to participate in this process, this could be a turning point in the struggle for control and management of IPSs.

Keywords*:* Invasive Plant Species; Conservation; Africa; Biodiversity; Management

INTRODUCTION
Plants are important components of the world's biodiversity and play a major role in global sustainability. Plants provide conditions and services such as food production, medicine, fuel, shelter, and means of financial income that are essential to sustain the life and well-being of humankind and animals. Plants also provide ecosystem services essential to life, including the removal of carbon dioxide emissions by sequestering carbon and production of oxygen, water purification, and infiltration, protection of watersheds, and stabilization and protection of soil. About 374,000 species of plants are currently known, described and accepted (Maarten and James, 2016).

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Many plant species have been impacted and are facing danger of extinction in nature (Blackmore *et al.,* 2001) due to the spread of invasive species, and human-induced activities such as over-exploitation, deforestation, overpopulation, and climate change.

Conservation can be described as the sustainable way to protect, manage, and utilize biodiversity resources to preserve social, economic, environmental, and cultural goals (Xuan Quynh and Hens, 2009). Species diversity can be conserved in two major ways: *In situ* and *ex-situ*. *In situ* conservation is commonly adopted in many regions of the world. It is regarded as an "on-site" conservation strategy which is the process of conserving or protecting genetic resources in the natural environment of plant and animal species. *Ex-situ* conservation is a wide range of strategies that are used to conserve biological diversity outside its natural environment such as gene banks, zoos, and botanical gardens. This form of conservation requires technicality and adequate scientific knowledge and can be capital-intensive (Xuan Quynh and Hens, 2009).

Invasive Plant Species (IPS) are one of the most significant threats to global biodiversity and ecosystem function. The IPS are non-native or alien to the ecosystem whose introduction causes or is likely to cause economic or environmental harm (Kareiva, 1996). These plant species can be either indigenous or non-indigenous species that heavily colonize a particular habitat and pose negative impacts economically, environmentally, or ecologically (Davis *et al*., 2015). These plant species are considered one of the greatest threats to the long-term conservation of biological diversity in both terrestrial and aquatic habitats (Wilcove *et al*., 2008; Mack *et al*., 2015; Lee and Macdonald, 2016). Invasive plant species can survive, reproduce, and spread at an alarming rate across an ecosystem causing detrimental effects in parks, land use changes, and giving rise to management problems (Poland *et al*., 2021). There are some key features associated with invasive plants which include showing prolific seeding at an early age of first reproduction, having unpalatable foliage, being easily established in degraded environments, and having the ability to regenerate abundantly from direct seeds, stems, or roots (Sudimier-Rieux, 2015). These features make invasive plants good competitors amongst other plant species and allow their survival and abundant establishment (Ahimbisibwe, 2014). Invasive plant species are particularly challenging to manage, as they can spread rapidly, outcompete native species, and have far-reaching impacts on ecosystem services (Vanderhoeven *et al*., 2017).

An introduced plant species might become invasive if it can out-compete native species for resources such as nutrients, light, water, or food (Tilman, 1993). Invasive species compete for space or resources, dominating the niches occupied by native species and excluding them from the natural environment. The competitive exclusion of these species can compromise the existence of rare species and other trophic levels, keeping communities in a constant state of disruption (Syliver *et al*., 2020). In Africa, invasive plant species are a growing concern, as they can displace native flora and fauna, alter ecosystem structure and function, and threaten the livelihoods of millions of people who rely on natural resources for their survival. Invasive species are responsible for over $2 trillion in damages worldwide, with Africa bearing a significant proportion of these costs (Simberloff *et al*., 2013). Therefore, it is essential to understand the prevalence of invasive plant species in Africa and their effects on conservation efforts.

Conservation in Africa is critical for protecting the continent's rich biodiversity and ensuring the sustainable use of natural resources.

Despite the efforts of numerous conservation organizations and governments, Africa's ecosystems continue to face multiple threats, including habitat destruction, climate change, and invasive species (World Wildlife Fund, 2021). Management and control of invasive plant species have been a tedious job according to multiple reports. It is important to have a better knowledge of the spread of invasive species and its negative impact on the ecosystem to know the best management approach. The lack of effective preventive or control measures for invasive species is due to little or no knowledge of the impacts of invasive species on the ecological environment. The knowledge gap that exists in the prediction of the adverse effects of invasive species and the possibility that they will occur in a particular habitat frustrates the accurate determination of risk these species can cause and also affects the appropriate prevention and control measures that would be needed (Simberloff *et al.,* 2005). Currently, little is known about the prevalence of invasive plant species in Africa, their effects on conservation and management strategies except for solitary articles reporting cases for individual countries.

This review aims to provide an overview of the prevalence of invasive plant species in Africa and their effects on conservation. It will examine case studies of invasive species in different African countries, their impacts on native ecosystems, and their economic and health implications, in addition, to the challenges and opportunities for managing invasive species in Africa, highlighting successful examples of invasive species management and control. It is crucial to note that over 100 articles were examined which were published from 2000 to 2023, all of which were found through searches on Wiley Online Library, Academic Journals, PubMed, Google Scholar, etc. We reviewed these articles about the invasiveness of alien plants in Africa and their effects on biodiversity and conservation efforts. For an article to be selected, it had to contain at least one keyword from each of the following groups: (a) 'invasive plant species', 'biodiversity', 'conservation', 'Africa' (b) 'Ecosystems', 'economic impacts', 'health hazards' (c) 'challenges', 'opportunities', 'management'. These criteria enabled us to narrow our articles down to 113 which were used for this paper.

Prevalence of invasive plant species in Africa

Overview of invasive plant species in Africa

Invasive plant species are non-native plants that are introduced to a new area and have negative effects on the environment, economy, or human health. Africa is home to a wide range of invasive plant species across a diverse range of taxa, which can cause significant damage to natural ecosystems, reduce biodiversity, and impact agricultural productivity (Nyambo *et al.,* 2011). Some of the most common invasive plant species in Africa include *Chromolaena odorata*, *Lantana camara*, *Prosopis juliflora*, and *Opuntia stricta*. The prevalence of invasive alien plant species (IAPS) has gone beyond free areas and is now being reported in protected areas across the world (Borokini, 2011). In his report, De Poorter *et al.* (2007) identified 487 protected area sites with invasive alien plant species recorded as an impact or threat; in 106 countries, protected area(s) have been recorded as having IAPS as an impact or threat.

Based on available online statistics, almost all countries in Africa are affected by IAPS. In 2004, the International Union for Conservation of Nature (IUCN) identified 81 IAPS in South Africa, 49 in Mauritius, 44 in Swaziland, 37 in Algeria and Madagascar, 35 in Kenya, 28 in Egypt, 26 in Ghana and Zimbabwe, and 22 in Ethiopia (IUCN, 2004).

Case studies of invasive plant species in Africa

Invasive plant species in Africa (Table 1) have been introduced through different pathways, including deliberate introduction for ornamental or agricultural purposes, accidental introduction through transport, and natural dispersal. Once established, invasive plant species can spread rapidly and outcompete native plant species, leading to significant changes in the composition and structure of ecosystems. In Western Africa, specifically in Ibadan, Nigeria, Borokini (2011) investigated the field gene bank of the National Centre for Genetic Resources and Biotechnology (NACGRAB) to identify the IAPS and evaluate their disturbance on the native species. It was reported that despite the small size of the gene bank, 25 plant invaders were identified, indicating a severe level of plant invasion at the site. It was estimated that the land covered by the IAPS on the field gene bank was up to 18% of the total land of the gene bank (Borokini, 2011). According to the United Nations Environment Programme (UNEP, Undated), alien plant species now cover more than 10.1 million hectares (ha), threatening the indigenous plants in South Africa. Also, according to the UNEP, *C. odorata* is considered a problem in Benin, Central African Republic, Congo, Cote d'Ivoire, Democratic Republic of Congo, Liberia, Mauritius, Nigeria, Senegal, South Africa, Swaziland, and Togo.

Ogbe and Bamidele (2006) reported that *Mimosa diplotricha* was located in and around Benin City invading fallow fields, corn, okra, cassava, and melon farms. It is capable of choking out other crops and it makes harvesting difficult in areas where it is present in large numbers because of its thorny nature (Ogbe and Bamidele, 2006). It was also found along the cattle trails where it was presumed to have been introduced as a result of the attachment of the seed to the cattle skin. Aigbokhian *et al*. (2011) reported that *M. diplotricha* was widely distributed in 13 southern states of Nigeria. They concluded that deforestation and frequent burning events, especially along open forest paths in the relatively dry forest zone may be responsible for the continued spread of *M. diplotricha*. Okereke and Mbaekwe (2011) reported four surveyed plots around Awka, Anambra State, Nigeria infested by *M. diplotricha* and attaining a density of 2010 stems m-2 in the infested plots. According to Olorode *et al*. (2011), *Tithonia rotundifolia* and *Tithonia diversifolia* are widespread along the forest border in Southern Nigeria. The prevalence of IAPS such as *Broussonetia papyrifera* (L.) L'Her. ex-Vent, *C. odorata* and *Eichhornia crassipes* have also been reported in Ghana (Asante and Amuakwa-Mensah, 2014; Asante *et al*., 2021; Osei *et al*., 2021). Maroun (2017) and Tiébré *et al*. (2018) observed that *L. camara* was prevalent and recorded in several localities in Côte d' Ivoire which include Alépé, Bongouanou, Dimbokro, Gagnoa, Grand-Bassam, and Issia.

In Central Africa, Data obtained from a study by Mbale *et al*. (2020) showed that out of the 35 plant species collected in general, 19 species were alien, but only 4 of the species, including *E. crassipes, Echinochloa pyramidalis, Pistia stratiotes*, and *Ludwigia peploid* exhibited invasive behavior. This was carried out in Pool Malebo and some rivers in Kinshasa city, Democratic Republic of the Congo. Michael *et al*. (2022) recently agreed with Mbale *et al*. (2020) in their study that *E. crassipes* and *E. pyramidalis* are the most notorious invasive plant species in the Pool Malebo Eco-region, Democratic Republic of the Congo. Kouam (2013) reported that Lake Nkolbisson in Cameroon is currently invaded by water hyacinths (*E. crassipes*). The proliferation of *E. crassipes* is one of the many problems that affect lentic and lotic freshwater environments.

Others include pollution of agricultural or industrial origin, road and mining earthworks, intensive local fishing, drying out linked to climate change, and siltation due to deforestation of watersheds (Dibong and Ndjouondo, 2014).

In Southern Africa, Yusuf *et al*. (2017) reported that three species *Acacia podalyriifolia, Chromolaena odorata,* and *Litsea glutinosa* were classified as invasive plant species in the Paradise Valley Nature Reserve, South Africa, and two species (*C. odorata* and *L. glutinosa*) were classified in the Roosfontein Nature Reserve, South Africa. Henderson (2007) revealed that a total of 548 naturalized and casual alien plant species were cataloged, and invasion was recorded along the whole of the Fynbos and Forest Biomes, and the moister eastern parts of the Grassland and Savanna Biomes in Southern Africa. It was reported that the *Fabaceae* is prominent in all biomes and *Acacia* with 17 listed species, accounts for a very large proportion of all invasions. *Acacia mearmii* was by far the most prominent invasive species in the study area, followed by *Acacia saligna, L. camara, Acacia cyclops, Opuntia ficus-indica, Solarium mauritianum, Populus albamcanescens, Melia azedarach, Acacia dealbata* and species of *Prosopis* (Henderson, 2007). *Glyceria maxima* was recognized as an emerging weed invader that is likely to cause serious problems soon in South Africa (Henderson, 2008). Eight alien plant species were identified in the Daan Viljoen Game Park (DVGP), Namibia, and their distribution, abundance, and population parameters were assessed and related to one another (Timothy *et al.,* 2008). The most common alien plant invaders identified in the DVGP were: *O. ficus–indica, Opuntia cf. dillenii, Opuntia cf. vulgaris,* and one unidentified *Opuntia* species.

Lantana spp. are invasive plants that spread quickly throughout Eastern Africa. They are found in many disturbed, uncleared areas and in cleared areas of Kibale National Park, Uganda, where dense thickets prevent the regrowth of local woody species (Omeja *et al*., 2011, 2016). Seven woody exotic plant species were studied in Mabira Central Forest Reserve, Uganda, three among these were reported to have population structures indicative of invasiveness and distributions an indication of the early stages of invasion (James *et al*., 2022). The three species included *Senna spectabilis* (DC.) H.S. Irwin & Barneby localized to an 8.6 ha site north of the reserve, *Terminalia superba* Engl. & Diels occurred mainly in an 8.7 ha patch south of the reserve, and *Artocarpus heterophyllus* Lam. was more widely distributed (James *et al*., 2022). As *S. mauritianum* was considered a noxious invasive pest plant in Kenya (Robert and Robert, 2006), Pauline *et al*. (2018) also reported that *Ziziphus mauritiana* was present along road corridors in northern Zimbabwe. It was also observed that it had a clustered and linear distribution along roads both in the Zambezi Valley and Highveld regions.

In Northern Africa, research on the prevalence of invasive alien plant species remains scarce, however, alien plant species have been recorded in Egypt, Algeria, Sudan, and Morocco. Kamal *et al*. (2016) reported in their study that 136 alien species were recorded, which related to 92 genera and 30 families of the Egyptian flora (Kamal *et al.*, 2016). According to Rachid *et al*. (2020), 211 vascular species of alien plants, belonging to 151 genera and 51 families were recorded in the flora of Algeria in their study area. About 16% of the alien species recorded were considered as invasive or potentially invasive. Omer *et al*. (2021) reported that Sudan had a total of 113 alien species of which 92 were already naturalized and 21 were still identified as alien species. Sudan had a total of 99 plants while South Sudan has a total of 59 plants.

Table 1: Invasive Plant Species Found in Different Countries in Africa

S/N	Country	Sample Source	Plant Species (Scientific names)	Plant Species (Common names)	Family	References
1	Ethiopia	Bale zone	*Vachellia seyal*	Shittim Wood	Fabaceae	(Mussa *et al*., 2018)
2	Ethiopia	Bale zone	*Acacia mellifera* (M. Vahl) Benth.	Blackthorn	Fabaceae	(Mussa *et al*., 2018)
3	Ethiopia	West Shewa and East Wollega Zones of Western Oromia	*Senna occidentalis*	Coffee senna or Septic weed	Fabaceae	(Fufa *et al*., 2017)
4	Ethiopia	West Shewa and East Wollega Zones of Western Oromia	*Xanthium spinosum* L.	Spiny cocklebur, Prickly burweed, and Bathurst burr	Asteraceae	(Fufa *et al*., 2017)
5	Kenya	Nairobi, Kiambu, Nandi Forest etc.	*Cestrum aurantiacum* Lindl.	Orange cestrum, "orange jessamine", and Yellow cestrum	Solanaceae	(Makokha, 2018)
6	Kenya	Western Kenya	*Solanum mauritianum* Scop.	Bug weed, Bug tree, Ear leaf nightshade, etc.	Solanaceae	(Robert and Robert, 2006)
7	Malawi	Nyika National Park (NNP)	*Pteridium aquilinum*	Bracken fern, pasture brake, Eagle Fern, etc.	Dennstaedtiaceae	(Kacheche and Mzuza, 2021)
8	Malawi	Nyika National Park (NNP)	*Lantana camara*	Lantana, Common Lantana, Shrub Verbena etc.	Verbenaceae	(Kacheche and Mzuza, 2021)
9	Malawi	Nyika National Park (NNP)	*Rubus ellipticus*	Golden Himalayan raspberry, or yellow Himalayan raspberry	Rosaceae	(Kacheche and Mzuza, 2021)
10	Mozambique	Maputo Special Reserve	*Lantana camara* L.	Lantana, Common Lantana, Shrub Verbena etc.	Verbenaceae	(Syliver *et al*., 2020)
11	Mozambique	Maputo Special Reserve	*Pinanga coronata*	Ivory Cane Palm	Arecaceae	(Syliver *et al*., 2020)
12	Nigeria	Field Gene Bank of NACGRAB	*Acalypha indica* Linn.	Indian Acalypha, Indian Copperleaf, etc.	Euphorbiaceae	(Borokini, 2011)
13	Nigeria	Field Gene Bank of NACGRAB	*Adenia cissampeloides* (Planch ex. Benth) Hams	Monkey rope and Snake climber	Passifloraceae	(Borokini, 2011)

Biological and Environmental Sciences Journal for the Tropics 21(1) April, 2024
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Table 1 cont.

14	Nigeria	Field Gene Bank of NACGRAB	*Cissus arguta* Hook. F.	IGBO (Okpanam) mpata moko (NWT)	Vitaceae	(Borokini, 2011)
15	Nigeria	Field Gene Bank of NACGRAB	*Dissotis rotundifolia* (Sin.) Triana.	Spanish Shawl, Pinklady, etc.	Melatomataceae	(Borokini, 2011)
16	Nigeria	Field Gene Bank of NACGRAB	*Euphorbia graminea* Jacq.	Grassleaf Spurge	Euphorbiaceae	(Borokini, 2011)
17	Nigeria	Field Gene Bank of NACGRAB	*Euphorbia heterophylla* L.	Mexican fireplant, Painted spurge, milkweed, etc.	Euphorbiaceae	(Borokini, 2011)
18	Nigeria	Ile-Ife, Osun	*Chromolaena odorata* (L.) King and Robinson	Siam weed, Christmas bush, devil weed, etc.	Asteraceae	(Augustine and Morodoluwa, 2013)
19	Nigeria	Ile-Ife, Osun	*Tithonia diversifolia* (Hemsl.) A. Gray	Tree marigold, Mexican tournesol, etc.	Asteraceae	(Augustine and Morodoluwa, 2013)
20	Nigeria	Owerri, Umuahia and Etche	*Mimosa pudica* L.	Sensitive plant, Humble plant, touch-me-not, etc.	Fabaceae	(Francis *et al*., 2022)
21	Nigeria	Owerri, Umuahia and Etche	*Mimosa diplotricha*	Giant sensitive plant, Creeping sensitive plant, etc.	Fabaceae	(Francis *et al*., 2022)
22	South Africa	Great Brak Estuary	*Spartina alterniflora* Loisel	Saltmarsh Cordgrass, Smooth Cordgrass, etc.	Poaceae	(Adams *et al*., 2012)
23	South Africa	Paradise Valley Nature Reserve	*Chromolaena odorata* (L.) King and Robinson	Siam weed, Christmas bush, devil weed, etc.	Asteraceae	(Yusuf *et al*., 2017)
24	South Africa	Renosterveld	*Avena fatua* L.	Common wild oats, Spring wild oats, etc.	Poaceae	(Sharma *et al*., 2010)
25	South Africa	KZN Rivers and wetlands	*Glyceria maxima* (Hartm.) Holmb.	Great manna grass, Reed mannagrass, etc	Poaceae	(Mugwedi 2012)
26	Uganda	Kibale National Park.	*Lantana camara* L.	Lantana, Common Lantana, Shrub Verbena etc.	Verbenaceae	(Omeja *et al*., 2016)
27	Uganda	Mabira Central Forest Reserve	*Senna spectabilis* (DC.) H.S. Irwin & Barneby	Golden wonder tree, American cassia, Popcorn tree, etc	Fabaceae	(James *et al*., 2022)
28	Uganda	Mabira Central Forest Reserve	*Terminalia superba* Engl. & Diels	Shinglewood, Frake, African limba, etc.	Combretaceae	(James *et al*., 2022)
29	Uganda	Mabira Central Forest Reserve	*Artocarpus heterophyllus* Lam	The jackfruit tree	Moraceae	(James *et al*., 2022)
30	Zimbabwe	Zambezi valley	*Ziziphus mauritiana* Lam	Indian jujube, Indian plum, Chinese date, etc.	Rhamnaceae	(Pauline *et al*., 2018)

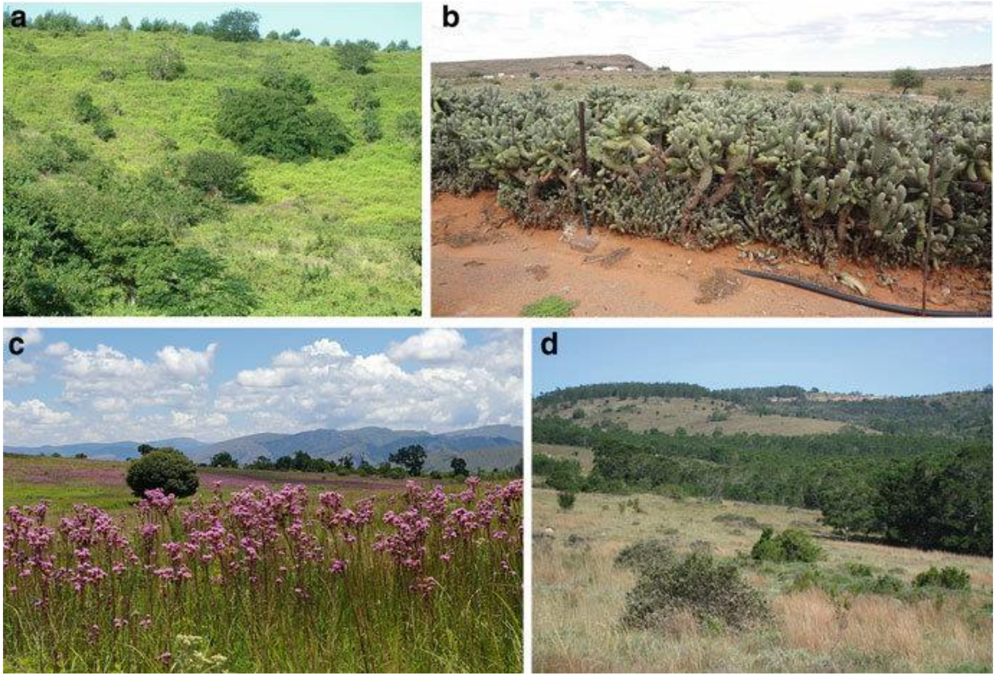

Figure 1. Examples of alien plants that invade rangelands in South Africa. (a) *C. odorata* (Triffid Weed) in the Indian Ocean Coastal Belt in KwaZulu-Natal; (b) *Cylindropuntia fulgida* var. mamillata (Boxing Glove Cactus) in the Northern Cape; (c) *Campuloclinium macrocephalum* (Pompom Weed) in grasslands, Gauteng; and (d) *A. mearnsii* (Black Wattle) trees invading grasslands, KwaZulu-Natal. Photographs courtesy of (a) Plant Protection Research Institute; (b) Travor Xivuri; (c) Lesley Henderson; (d) John Hoffmann. (O'Connor and van Wilgen, 2020).

Figure 2. *M. diplotricha*, found in Egor L.G.A. Benin City Nigeria. (Courtesy: Dr. Emmanuel Aigbokhan, Department of Plant Biology and Biotechnology, University of Benin) (Augustine and Morodoluwa, 2013).

Figure 3. *Nypa fruticans*, **found along Stubbs Creek Forest Reserve, Kwa Ibo**, Akwa Ibom State, Nigeria (Augustine and Morodoluwa, 2013).

General impacts of invasive plant species in Africa

Impacts of invasive plant species on biodiversity conservation and ecosystem

Invasive alien plant species have been identified as a major threat to biodiversity (Liu *et al.*, 2017). Invasive alien plant species (IAPs) are among the species whose naturalization threatens the biological biodiversity and functions of the ecosystem in their new geographic region (Mostert *et al.,* 2017; O'Connor and van Wilgen, 2020). Invasive species are responsible for the homogenization of flora which causes a substantial threat to biodiversity and ecological integrity of native habitats and ecosystems (Hulme, 2003).

Kacheche and Mzuza (2021) reported that invasive plant species had negative impacts on the native species in the Nyika National Park (NNP), Malawi. The main effects recorded were changes in physical habitats such as loss of native habitats, alteration of groundwater regime, alteration of surface water, drying of rivers, loss of native species, alteration of biomass, loss/decrease of native species through competition for food, loss/decrease of native species through competition for habitat, harbors pathogens which lead to loss of native species and decrease in the growth rate of native species. These losses affect the livelihood of the people surrounding the park. Most families directly depend on the products from the park for their survival (Kacheche and Mzuza, 2021). Mussa *et al*. (2018) reported that invasive plant species had a significant negative impact on the biodiversity and ecosystem in Ethiopia. Mussa *et al*. (2018) also reported that 45.1% of the respondents questioned stated that the plant species threatened the local plants. Invasive species may cause changes in environmental services, such as flood control and water supply, water assimilation, nutrient recycling, conservation, and regeneration of soils, and may also affect native species by introducing pathogens or parasites that cause disease or kill native species (GISP, 2004).

Invasive plants have been well reported to pose both direct and indirect threats to the population and survival of native plant species.

Invasive species may cause changes in environmental services, such as flood control and water supply, water assimilation, nutrient recycling, conservation, and regeneration of soils (Levine and D'Antonio, 2003; Global Invasive Species Programme GISP, 2004). Invasive plant species invasions can have devastating population, community, and ecosystem impacts (Parker *et al*., 2013) such impacts may include the loss of native species, disruption of energy and nutrient webs, and unstable production systems (Davis *et al*., 2015).

Economic impacts of invasive plant species

Invasive plants hinder crop production by claiming agricultural lands and serving as a hiding place for crop pests and wild animals. The livestock feed shortage is also further complicated by the introduction and expansion of unwanted bushes and invasive weeds (Abate *et al*., 2010). The existing biodiversity and people's livelihood are threatened due to invasive plant species (Mohammed *et al*., 2016). Mussa *et al.* (2018) reported that 5.7% of respondents in their survey stated that plant species reduced crop output, while 8% agreed that the species negatively affected animal products. In the study areas, the local community expressed their views about the effect of *parthenium* on the quality of animal products. They reported that the milk had a bitter taste (Mussa *et al*., 2018).

Corin *et al.* (2017) reported that *Parthenium hysterophorus* infestations can result in livelihood impacts beyond smallholder crop yield losses, with school-age children, for example, spending days weeding and missing key periods of education, limiting prospects. In addition, extended exposure to this allergenic weed can cause skin and respiratory problems (Corin *et al.,* 2017). This is supported by Fessehaie *et al.* (2005) who reported that dense infestations of parthenium can eventually lead to land abandonment, with huge socioeconomic ramifications. Estimates (CABI, unpublished) of the current value of time invested by small households in weeding *P. hysterophorus* at a basic labor rate calculated for each affected study country give annual figures of US$0.2 million in Uganda; US$0.3 million in Tanzania; US$1.5 million in Kenya; and US$16.8 million in Ethiopia (Corin *et al.*, 2017).

Mussa *et al.* (2018) also reported that invasive plant species served as a source of fodder and nectar, hedges, firewood, medicine, food, construction, and charcoal. Furthermore, Mussa *et al.* (2018) reported that invasive plant species had ecological functions such as combating desertification, soil erosion control, reduction of wind speed, shelter for wildlife, and shade trees. Invasive plant species such as *Acacia* species are widely used by pastorals as fodder for browsers, nectar for bees, charcoal, medicine against different diseases, fuel wood, and construction material (Shackleton *et al*., 2017).

Impacts of invasive plant species on health

Some invasive alien plants impact negatively on human well-being and health, both directly and indirectly. Direct negative impacts are often similar in both the native and invaded ranges, while indirect impacts are likely to cause more harm in the latter because they represent a novel element in existing ecological networks. (Callaway *et al.,* 2012; Sun *et al.,* 2013). Moving to the direct impacts, the impacts of invasive plant species on human health have recently gained increasing attention in medical research and invasion ecology. The impacts of invasive non-native species on human health vary from psychological effects, discomfort, nuisance, and phobias to skin irritations, allergies, poisoning, disease, and even death (Vilà and Hulme, 2017). The human health impacts of invasion are further exacerbated by the rapid spread of vector-borne pathogens (Clow *et al.,* 2017, Schindler *et al.,* 2018).

Biological and Environmental Sciences Journal for the Tropics 21(1) April, 2024
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Invasive species have an indirect effect on human health through changes in environmental quality (air, water, and soil quality) and ecosystem structure (biodiversity, food availability, and land-use change) and can facilitate exposure to toxins and allergens leading to disease, injury and even death (Jones and McDermott, 2018). There is a growing appreciation for research on the negative health externalities of invasive species. The WHO warns that the continuing spreading of invasive species worldwide can have significant impacts on public health (Jones and McDermott, 2018). Pyšek and Richardson (2010), suggest that millions of people around the world face disease, injury, and even death due to invasive species. The continuing increase in the event of invasion may be due to changes in climatic conditions and continued globalization (Jones and McDermott, 2018). Certain IAPS may act as an ecological indicator of environmental pollution (Rai and Singh, 2020). Ash trees are one example of an invasive species that can act as a sink for air pollutants (Rai and Singh, 2020).

According to Mussa *et al*. (2018), 17.8% of the respondents in their study revealed that some of the plant species have problematic thorns that cause problems to both humans and animals. Furthermore, studies reported by Lemma *et al*. (2015) and Belayneh *et al*. (2016) agreed with the above, they revealed similar harmful impacts of invasive plant species on pastoralists and agro-pastoralists. The thorns of the plants inflict wounds on legs, hands, and eyes causing blindness, lameness, and even amputation of legs and hands due to infection of wounds (Mussa *et al*., 2018).

Impact of invasive plant species on ecosystem services

Ecosystem services are the benefits provided to human society by natural ecosystems, it refers to the ecosystem processes by which human life is maintained (Heather and Dukes, 2008). The concept of ecosystem services is not new, and there have been multiple attempts to list and/or categorize these services, especially as the existence of additional services has been recognized (Daily, 1997; N.R.C., 2005). The services listed below are primarily those enumerated in the Millennium Ecosystem Assessment (M.E.C., 2005) with minimal variation in wording. The framework places services into four categories.

i. Provisioning services are products obtained from ecosystems and include food (crops, livestock, fisheries, etc.), freshwater, fiber (timber, cotton, silk, etc.), fuel, genetic resources, biochemicals/pharmaceuticals/natural medicines, and ornamental resources (M.E.C., 2005).
ii. Regulating services are obtained from the regulation of ecosystem processes, and include air quality regulation, climate regulation, water regulation (timing and extent of flooding, runoff, etc.), water purification, waste treatment, disease regulation, natural pest control, pollination, erosion control, and coastal storm protection (M.E.C., 2005).
iii. Cultural services are non-material benefits and include aesthetic values, recreation/tourism, spiritual/religious values, educational/scientific values, cultural heritage values, inspiration, and a sense of place (M.E.C., 2005).
iv. Supporting services are overarching, indirect, and occur on large temporal scales, but are necessary for the maintenance of other services. They include photosynthesis, primary production, nutrient cycling, water cycling, soil formation, and maintenance of fertility, as well as atmospheric composition (M.E.C., 2005).

This framework includes both goods, which have direct market values, and services that in turn maintain the production of goods and biodiversity, and directly or indirectly benefit humans (Daily, 1997).

IPS can have complex and sometimes have beneficial impacts on rural low-income communities in particular (Richardson and van Wilgen, 2004). For example, in South Africa, invasive *Acacia* and *Pinus* species have resulted in reduced stream flow and increased fire intensity (Richardson and van Wilgen, 2004). However, these species are also important 'ecosystem goods' that are now used for thatching, timber, medicine, charcoal, and firewood by local communities; the economic value of the firewood alone is US$2.8 million (De Neergaard, *et al*., 2005).

Litt *et al*. (2014) stated that naturalized alien plant species are among the significant ecosystem drivers that pose major threats to the native communities (e.g., plants and arthropods) in natural and agricultural ecosystems. According to Valone and Weyers (2019), the increase in the intensity of invasion aggravates the degree of threat to biodiversity and ecosystem function. Ecosystem services can be impacted directly or indirectly by changes in species and community structure. One of the direct results is a decrease in the number of economically valuable species, especially those that are utilized as fuel, food, fiber, fodder, or medicine. Option value is also lost as a result of the extinction of species and decreased genetic variety. For instance, the loss of numerous birds and other species in Guam is attributed to the brown tree snake (*Boiga irregularis*), which also has detrimental effects on tourism and undetermined costs to genetic resources (Fritts and Rodda, 1998), while the indirect effects include a potential decrease in ecosystem resistance and resilience to change, due to the hypothesized link between stability and changes in biodiversity (Hooper *et al*., 2005). Lastly, positive feedback resulting from interactions between invasive species may make an ecosystem more vulnerable to future invasions and possibly worsen its services (Simberloff and Von Holle, 1999). Globally, exotic species invasion has altered ecosystem structure and function (Crooks, 2002). Non-native species impact ecosystems through competition with and predation on native species, and by altering habitats, nutrient cycles, and energy budgets (Baxter *et al*., 2004).

Pejchar and Mooney (2010) stressed the importance of tackling IAS. They reported that much of invasion biology focuses on ecological effects, predicting spread, and developing control methods rather than documenting the economic and social damage IAS does to society from impacts on ecosystem services. Because ecosystems provide life-support services to all of human society, using the ecosystem-service framework for prevention and control of IAS has the potential to reach the adverse audience and give them a stake in the outcome of IAS introductions (Pejchar and Mooney, 2010). In the coming years, IAS will be a major driver of global environmental change, with grave consequences for biodiversity and human well-being, just as they have been a major driver for habitat loss and climate change (Pejchar and Mooney, 2010).

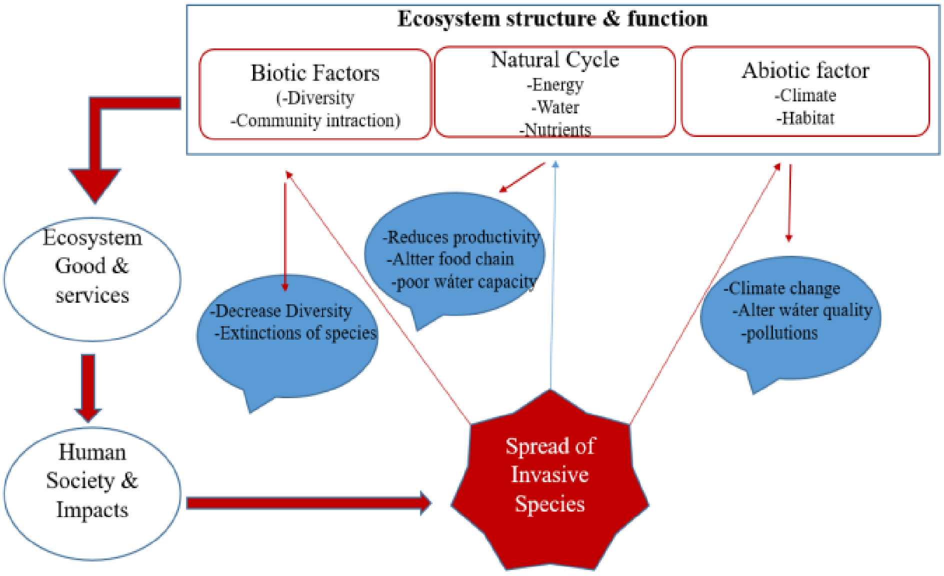

Figure 4. First and foremost, invasive species quickly transform ecosystems by modifying the biotic and abiotic environments.(Figure modified from Charles and Dukes, 2008).

Management and control of invasive species

In the 1990s, water hyacinth (*E. crassipes*) invaded Lake Victoria in Kenya and caused significant ecological and economic problems. However, a biological control program was launched in the early 2000s, which involved introducing two species of weevils (*Neochetina bruchi* and *N. eichhorniae*) that feed on the plant. The weevils successfully reduced the water hyacinth population, and the lake's ecological and economic situation improved significantly (Mwende and Njoka, 2005). Eradication of invasive plant species on Robben Island, South Africa Robben Island, a UNESCO World Heritage Site off the coast of South Africa, was invaded by several non-native plant species in the 19th and 20th centuries. In the 2000s, a program was launched to eradicate these invasive species and restore the island's native vegetation. The program involved the use of herbicides, manual removal, and the reintroduction of native plant species. The program was successful, and the island's native vegetation has been restored (Brian *et al*., 2012).

Thabiso *et al*. (2024) investigated the use of herbicides to eradicate *Tephrocactus articulatus* a problematic invasive plant species in South Africa. Thabiso *et al*. (2024) reported that the foliar spray method significantly suppressed populations of *T. articulatus* in most of the sites in their study, this result encouraged the management of emerging biological invasions in South Africa. This finding complements the previous reports that herbicides are known to be more effective than mechanical methods (Martens *et al*., 2021).

The Cochineal Insect (*Dactylopius ceylonicus*) was the biological control agent used in South Africa to manage the Drooping Prickly Pear (*Opuntia monacantha*). According to Moran *et al*. (2013), this was South Africa's first release of a biological control agent.

Also, the release of biological control agents against *O. ficus-indica* (Mission Prickly Pear) led to spectacular success and biological control of invasive alien plants became an effective method for reducing populations of several important invasive plants. Matthews and Brand (2004) reported that the invasive Australian rooikrans tree (*A. cyclops*) can be effectively controlled by mechanical means alone by cutting and pulling roots as long as sufficient labor is available in South Africa. Mechanical control is labor-intensive and thus expensive to use in extensive and dense infestations, remote or rugged areas (van Wilgen *et al*., 2001). In Nigeria, mechanical control of water hyacinth was estimated to cost US$ 639 per hectare (Kasulo, 2000).

Challenges in managing invasive species

Lack of funding and resources

The economic impact of managing invasive species has both negative and positive values depending on the situation at hand (Goodenough, 2010; Shackleton *et al.*, 2019). It is more costly to prevent the invasion of invasive species than to control it (Leung *et al.,* 2002) and the eradication of infestation occupying a smaller part of invasion can be easier (Pluess *et al.,* 2012) than controlling the larger area. The importance of consistent funding for effective control of invasive species cannot be overemphasized. For instance, the Galapagos Archipelago experienced failure in plant eradication projects due to inconsistent funding, and about 38% of failed projects were recorded (Gardener *et al.,* 2010). In Florida, the availability of consistent funding resulted in the eradication of Australian paperbark (*Melaleuca quinquenervia*) and water hyacinth (*E. crassipes)* (Funk, 2014).

According to Williams *et al*. (2021), it was observed that overall, in Kenya, a lack of finance, and a clear mandate for leadership were major barriers to effective system performance of managing invasive species, alongside this, the lack of a central coordinating body to guide invasive species management is also a huge barrier (Williams *et al*., 2021). In South Africa, the Working for Water Program was started in October 1995 with a budget of R25 million for the management of invasive species (Marais *et al*., 2004). Marais *et al*. (2004) reported that the annual expenditure on Working for Water operations increased from R25 million in the 1995/96 financial year to over R400 million in 2003/04, with R1.95 billion having been spent up to and including the 2002/03 financial year and y*et al*l invasive species targeted are not completely eradicated. Zengeya and Wilson (2020) reported that the South African government has implemented legislation to deal with alien invasions, investing over 1 billion ZAR per year to protect natural assets from their impacts. The number of emerging and invasive species is increasing and the resources for managing them are the main limiting factor. The need for more innovative approaches is imperative (Zengeya and Wilson, 2020).

According to Forsyth *et al.* (2012), the poor management of invasive alien plants (IAPs) occurs due to the disbursement of funds and attention given to low-priority catchment areas rather than high-priority catchment areas. In that study, they used an analytic hierarchy process (a multi-criteria decision support technique) to develop and rank criteria for prioritizing alien plant control operations in the Western Cape, South Africa. Forsyth *et al.* (2012) reported that they used the South African Plant Invaders Atlas (SAPIA, Henderson, 2007) to derive a list of species that were known to occur in >10% of the study area and had the potential to be highly invasive. They focused on six primary catchments collectively containing 309 quaternary catchments in the Western Cape region.

From the results, it was observed that in many cases catchments given the highest priority did not have any clearing projects while others with low priorities received funding (Forsyth *et al*., 2012).

Eschen *et al*. (2021) reported that the total estimated economic cost of IAS to agriculture in Africa is USD 65.58 Bn per year, some of these countries are Algeria, Djibouti, Somalia, Mauritania, Zambia, Niger, Malawi, Mozambique, Democratic Republic of the Congo, etc. This aligns with the findings of Diagne *et al*. (2021) whose estimate was dominated by agricultural costs. It's imperative to mitigate the effects of economic impacts of invasive plant species due to the potential damage estimated to occur in the next 10 years.

Limited capacity and knowledge

Identification and Monitoring: Limited capacity and knowledge may hinder the accurate identification and monitoring of invasive plant species. Without proper training and expertise, it can be challenging to differentiate between native and invasive species or to detect new invasions promptly. This is in agreement with reports of Jarrad *et al*. (2011) who stated that lack of knowledge and early detection can cause double the damage of established IPS. It is important to detect IPS early and respond quickly as such actions are decisive in preventing invasions (Kaiser and Burnett, 2010). Early detection can be improved by innovative tools like monitoring for environmental DNA (Ficetola, *et al*., 2008).

Understanding Ecology and Impacts: Invasive plant species often have complex ecological interactions and can cause a range of negative impacts on ecosystems. Limited capacity and knowledge may result in a lack of understanding of these ecological dynamics and their implications for conservation and management strategies.

Control and Management Techniques: Effective control and management of invasive plant species require knowledge of various control techniques, including mechanical, chemical, and biological methods. Limited capacity and knowledge may limit the adoption and implementation of appropriate control measures, leading to ineffective management outcomes. Zanden *et al*. (2010) reported that eradication methods for invasive species are effective only if they are completed at the initial stage of propagation and if the mode of invasion and spread of invasive species in question are well understood. To some extent eradication process of well-established invasive species may be the reason for the release of one earlier suppressed non-invasive species to invade a particular area (Caut *et al*., 2009). Hence, the eradication process needs a lot of monitoring of the specific areas where these invasive alien species are proliferating so, that further invasion can be prevented (Caut *et al*., 2009).

Policies and regulations

Comprehensive evidence-based policymaking is important for effective management of invasive species in Africa. In the mid-1800s, an evidence-based policy-making lens was used to trace biological invasion-related policy and legislation in South Africa. This was done to evaluate the evolution of biological invasions over time in response to changes in politics, science, public views, etc, (Lukey and Hall, 2020). There should be strong public policy and regulation to align the incentive of private policy or decision-makers with the achievement of social objectives for the management of biological invasions (Perrings *et al.*, 2002).

Kenya has established the Forests Act of 2005, which provides legal provisions for the management and conservation of forests, including measures to control invasive plant species. Additionally, the National Environment Management Authority (NEMA) is responsible for implementing environmental policies and regulations, including those related to invasive species management (NEMA, 2005).

South Africa has enacted various policies and regulations to address invasive plant species, including the National Environmental Management: Biodiversity Act of 2004 and the National Environmental Management: Protected Areas Act of 2003. These laws provide the legal framework for managing invasive species and protecting biodiversity (Department of Environment, Forestry and Fisheries, 2004). The Working for Water Programme, launched in 1995 is one of South Africa's successful initiatives for controlling IPS (Hobbs, 2004).

Tanzania implemented the Plant Protection Act of 1997 section 37 in a bid to control the vast impacts of invasive species in the country (Lyimo *et al*., 2009). Additionally, Tanzania also developed the Environmental Management Act of 2004, which provides the legal basis for managing environmental issues, including invasive species. The Tanzania Forest Services Agency (TFS) is responsible for implementing forestry policies and regulations, including measures to control invasive plant species in forested areas (FAO, 2004).

The United States has several federal laws and regulations aimed at managing invasive plant species, including the Federal Noxious Weed Act of 1974 and the Plant Protection Act of 2000. These laws authorize the USDA's Animal and Plant Health Inspection Service (APHIS) to regulate the importation, interstate movement, and eradication of invasive plant species. Additionally, individual states have their own regulations and management plans to address invasive plants. (USDA APHIS, 2002).

Opportunities for managing invasive species

Collaboration and partnerships

Researchers and practitioners have encouraged collaborative management in recent years as an approach to address these invasive species threats (Graham *et al*., 2019; IUCN World Heritage Outlook, 2020). Collaborative management allows stakeholders across different property, tenure, and jurisdictional boundaries to work together while balancing their priorities and interests (Graham *et al*., 2019). It can also reduce uncertainties around factors such as financial and other resource issues by pooling resources and creating long-term ties among stakeholders (Graham and Rogers, 2017).

Ethiopian Biodiversity Institute (EBI, undated) stated that Ethiopia has recognized the urgent need to address the problems of invasive alien plants, and has teamed up with CABI Africa and the World Conservation Union (IUCN) to implement a Regional Project entitled "Removing Barriers to Invasive Plant Management in Africa" involving three other pilot countries: Ghana, Uganda and Zambia. The PDF-A & B phases of the aforementioned "Project" have been successfully implemented and the four-year Full Project is now formally approved and jointly funded by the Ethiopian Government and the Global Environment Facility (GEF) through the United Nations Environment Program (UNEP).

Graham *et al*. (2019) identified four types of collaborative actions which include externally led, community-led, comanaged and organizational coalitions. Externally led collective actions were envisioned, championed, and funded by agencies or organizations, such as national, state, or local governments, international nongovernment organizations (NGOs), state-sponsored extension programs, or university research teams. This type of collective action strongly resembles the external agency-led type described by Uetake (2013). Community-led collective action typically involved private landowners, residents, and sometimes public land managers collaborating to control invaders, often without government mandates or leadership.

Comanaged collaborative actions involved agencies or organizations (e.g., state and local government agencies, private companies, NGOs, and universities) and private landowners and residents. Cooperation between them could be induced or motivated through diverse mechanisms, such as regulations and litigation (Graham, 2014), incentives (Ervin and Frisvold, 2016), technical assistance and educational outreach (Kruger, 2016), and community-based approaches (Graham, 2014). Organizational coalitions involved organizations such as Cooperative Weed Management Areas or Cooperative Invasive Species Management Areas in the United States (i.e., partnerships of local, state, and federal government agencies, private landowners, interested stakeholders, and organizations with environmental mandates). The purpose of such organizational collaborations was to coordinate invasive species management programs and activities, pool resources, encourage consistent regulation and engagement (Higgins *et al.*, 2007), or facilitate management at appropriate ecological scales (Thomsen and Caplow, 2017).

Uetake (2013) reported that collective action is useful and proved to be a success in managing agri-environmental commons in 25 case studies from 13 OECD countries. Rawat *et al*. (2010) reported that Joint Forest Management (JFM) was a collaborative and coordinated approach among different stakeholders (e.g., state forest departments and local communities) for sustainable forest management, soil and water conservation, rehabilitation of degraded lands, safeguarding biodiversity and forest ecosystem management, and livelihood enhancement in India.

Public awareness and education

One of the major actions that could help control biological invasion is to educate people about the issues of invasive species and the need for management and control (Marchante and Marchante, 2016; Novoa *et al.,* 2018). The current dearth of information on invasive species management is a serious issue that needs to be addressed. Many people in Africa are not aware of invasive species and their impacts while those who have prior knowledge perceive them as beneficial (Jubase *et al.,* 2021). The knowledge of invasive species especially to those in local communities in Africa is very important in managing and controlling their spread and impacts (Jubase *et al.,* 2021). Awareness of invasive species in some of the urban areas in South Africa despite the impacts of biological invasions and their efforts in educating people on invasive species (Murray 2005; Byrne *et al.*, 2020); is very low due to many factors which include the limited exposure of the residents to origin of invasive species and their resulting impacts on the ecosystem (Colton and Alpert, 1998; Shackleton and Shackleton, 2016). This low awareness may hinder their control and increase their spread which negatively impacts the ecosystem (Kapler *et al.*, 2012; Zengeya *et al.*, 2017)

Innovation and technology

Innovations and new technologies have been adopted to address the issues of invasive species (Kamenova *et al.,* 2017). Technologies like machine learning and the use of social media have also been used and proved effective in managing the spread of native species. Social media one of the cost-efficient and most accessible technology platforms can be used to improve data collection of biological invasions and inform detection and response strategies (Martinez *et al.*, 2020). Daume (2016) stumbled on an analysis posted on Twitter about a few invasive species that provided strong evidence for the life cycle activities such as the adult emergence of *Agrilus planipennis* (Emerald ash borer). It also serves as a means of accessing public views and perceptions of invasive species and their management.

Utilization of invasive plant species

This concept is a very unpopular approach as a lot of countries depend solely on either biological, mechanical, or chemical methods of control. It is already being practiced in some African countries such as Sudan, Mali, Senegal, South Africa, and Gambia and this is a call for other African countries to emulate. It is a process whereby these invasive plant species are exploited and used for the benefit of the people. Some reports have been documented on the utilization of these invasive plant species. For instance, utilization of *Prosopis julifora* has revealed that the wood is a good fuel; the timber is hard and compares significantly with the best hardwoods such as Teak and Mahogany. (Pasiecznik *et al*., 2001). Admasu (2008) reported that the sweet nutritious pods are enjoyed by all cattle and are turned into many cuisines and drinks. The flowers supply high-quality honey, the gum is similar to gum Arabic, and the barks and roots are substantial in tannin. In Ethiopia, the pods are used to manufacture flour for cakes, biscuits, and bread, as well as pop syrup, coffee alternatives, and animal feed. Prosopis pods are also used in Sudan for livestock fodder (Abedelnoor *et al.,* 2009). According to Tanko (2007), Typha grass **(***Typha australis***)** a native of the United States and Europe, found its way into African rivers over 20 years ago, and within a few years, the typha grass had infiltrated more than 60% of Northern Nigeria's lowland floodable agricultural areas, as well as major rivers in the region. However, processes for converting typha grass to "green charcoal" have been put in place in Mali, Senegal, and Gambia. Caro *et al*. (2011) reported that in Senegal, an estimated 65,000 tons of charcoal can be produced from typha in a year, which serves 15% of charcoal demand in Senegal and reduces pressure on the forests. According to Semanya *et al*. (2012), the Thulamela Local Municipality in South Africa would be a highly susceptible market for brooms made from *L. camara* if they were well advertised. The use of *Ricinus communis* (lubricant) and *Caesalpinia decapetala* (soap and lubricant) seeds may lessen their ability to disperse (Semanya *et al.*, 2012). Similarly, feeding domestic doves pounded fruits (seeds included) of *S. mauritianum* may lessen their ability to disperse.

CONCLUSION

Invasive plant species are non-native plants that are introduced to a new area and have negative effects on the environment, economy, or human health. They can displace native species, alter ecosystems, and threaten livelihoods. In Africa, the total estimated economic cost of IAS to agriculture in Africa is USD 65.58 Bn per year (Eschen *et al*., 2021).

Although invasive species can sometimes be useful such as offering ecological services to help disadvantaged rural communities improve their economic standing, their ability to rapidly adapt to various ecosystems and survive in different conditions is a problem for conservation. Over the years, conservation sites have often been exposed to invasive species that destroy the management of the targeted species. Around the world, there are very few ecosystems that are entirely free of introduced species, and an increasing number of biomes, ecosystems, and habitats are coming under the dominance of alien species (Pyšek and Richardson, 2010). This is because the introduction of invasive species which frequently function differently from other members of the recipient group, has an ecological influence that spreads along the food chain (Gallardo *et al.*, 2015). Therefore, their control is necessary if the aim of conservation is to be achieved.

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Call to action for effective management and control of invasive species

Invasive species hurt the social, economic, and health aspects of many farmers, and they are known to inflict significant losses with significant control expenses (Williams *et al*, 2021). Therefore, measures must be taken to prevent their establishment early as it is more effective than control. Preventing the introduction of new and potentially invasive taxa is a critical component of any invasive alien species management approach (van Wilgen, *et al*, 2011). A toolkit of invasive alien species best management and prevention practices provided by Wittenberg and Cock (2001), explored the measures that must be taken to develop a strategy and policy for invasive alien species management and listed institutional and national support for the prevention, early diagnosis, assessment, and management of invasive alien species as one of the best measures for control. They stressed the importance of identifying and involving all stakeholders before formulating a national plan, as well as the need for a single lead coordinating organization or, in the case of an interagency approach, clearly defined and assigned duties and responsibilities.

Already, European countries have the new Invasive Alien Species (IAS) regulation from the European Union (EU) which is an innovative and admirable attempt to establish a uniform standard for IAS control across political jurisdictions on a global scale. Recognizing that both terrestrial and aquatic IAS constitute a threat to Europe's economy, public health, and biodiversity, the EU passed laws in September 2014 with the specific purpose of coordinating and enhancing Member States' (MS) existing fragmented efforts to tackle IAS (Tollington *et al*., 2016). This move has facilitated various advantages for EU member countries against tackling invasive species, and this is one that Africa can learn from. From our research, it is evident that a large number of African countries lack policies and regulations to prevent and control invasive alien species and this is a call for immediate action to be taken taking a cue from Europe.

One might claim that using invasive species could help manage them while also offering ecological services to disadvantaged rural populations. Commercial utilization of invasive alien plant species can help disadvantaged rural communities improve their economic standing. It is therefore important that other African countries who are yet to utilize invasive plant species should consider maximizing the opportunity as this could be a watershed moment in the struggle for control and management of invasive plant species.

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