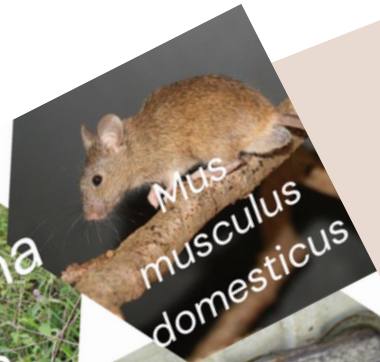
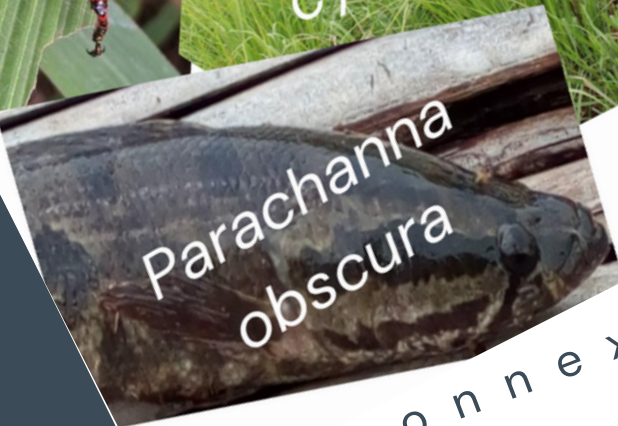


HOW ALIEN SPECIES IMPACT BIODIVERSITY:

THE CASE OF CAMEROON



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GENERALITY

Also referred to as introduced, unwanted, and non-native species, invasive species are the alien species that invade habitats and displace other species through rapid growth and spread.

They are found in areas beyond their known historical range and include introductions from other continents, bioregions, and those not native to the local geographic region (Melvin 1999; Richardson et al. 2000). Indeed, their dispersion is due to the worldwide intensification of human associated exchanges that makes previous biogeographical barriers meaningless and thus favours the multiplication of invasion processes at various geographical scales (Searle 2008).



Wherever they are introduced, they can quickly supplant native species and dominate the ecosystem, thus reducing biodiversity through their exponential proliferation, in turn depriving native species of space, nutrients and humidity, in short they modify the entire structure and functioning ecosystems.

Considered by the International Union for Conservation of Nature (IUCN) as one of the main threats to biodiversity and the integrity of ecosystems, invasive species are now considered the third factor threatening global biodiversity, after the destruction of habitats and the overexploitation of species according to the IUCN Red List (Kirchner & Soubeyran 2007).

Among the direct drivers of biodiversity loss, can be identified changes in land and sea use, overexploitation of natural resources, climate change, pollution and biological invasions affirmed by the Intergovernmental Science and Policy on Biodiversity and Ecosystem Services (IPBES).

With the presence of invasive species, the competition/predation effect takes hold in ecosystems, and the reduction in species' richness and diversity can reach 90% under such conditions (Hejda et al. 2009).

In the terrestrial as well as the aquatic environment, invasive species generally cause significant financial losses wherever they are introduced. They interfere with the use of natural resources such as fisheries. They also cause significant losses to agricultural production and affect food security which is a major concern for many African governments (MacDonald et al. 2003).

Finally, from a human health perspective, invasive alien species can contribute to increased rates and severity of natural disasters, disease and loss of life (Hytec & Mary 2010). The effects of invasive alien species are, in most cases, irreversible unless successful biological control can be implemented with other Integrated Pest Management (IPM) strategies.

II-ALIEN INVASIVE SPECIES IN CAMEROON

Due to the country's geographical position and climatic variations, Cameroon, like many countries in the world, has not been spared by invasive species.

Many alien species have been introduced into agriculture, forestry, horticulture, arboriculture, animal husbandry and fish farming aided by global trade (Anonymous 2008).

Based on data provided by the Global Invasive Species (GIS), the Ministry of Environment (MINEPDED 2015), and studies by Kenfack (2017), Kenfack et al. (unp.), the number of invasive species in Cameroon continues to increase with nearly 164 species recorded. Among these invasive species, 92 taxa belongs to crops pests and diseases, 36 are plants, 26 belong to animal and human diseases, while 11 are recorded in the Aquatic life and animals taxa.

Although invasive species may play an important role in the dispersion of crops seed through transportation to new environment (animal alien species), in phytoepuration (aquatic alien species), and as food for feed (aquatic and terrestrial), their negative impacts are more important and have imposed pressure on biological diversity, such that there is an urgent need to create interest and awareness regarding functional biodiversity (Rastogi and Kumar 2009, Rastogi 2011), biodiversity conservation (Kearns 2010), and the economic resources provided by biodiversity (Nijkamp et al. 2008).

II.1. ANIMAL ALIEN SPECIES

Of the animal alien species, rodents, grasshoppers, locusts and fish will be the focus of this article for terrestrial and aquatic environment respectively.

II.1.1. Terrestrial alien species

Considered as one of the more diverse taxa in the world, and playing an important role in the recycling and equilibrium of natural ecosystems, grasshoppers are known to be herbivore insects common to grassland ecosystems worldwide (Lockwood et al. 2000, Branson et al. 2006; Zhang 2011, Hao et al. 2015).

a-Grasshoppers and locusts

They are recorded in all climatic seasons, but more abundant during the dry seasons. Among the grasshoppers, some species are considered to be very harmful. Indeed, according to a study carried out by Ngoute et al. (2021) in tropical forest areas of southern Cameroon, of the grasshoppers investigated during their study, *Zonocerus variegatus* was recognized as a pest with economic impact especially during the dry season. Moreover, over the past 10 years, it has been shown that their damage has increased as forest destruction has increased (Ngoute et al. (2021)). Among the most harmful damage and effect of grasshoppers in Cameroon, can be listed:



Zonocerus variegatus
from Zamakoe.by Charly Oumarou Ngoute

- The damage on crops, and vegetables such as cassava (*Manihot esculenta*), corn (*Zea mays*), groundnut (*Arachis hypogaea*, and okra (*Abelmoschus esculentus*),

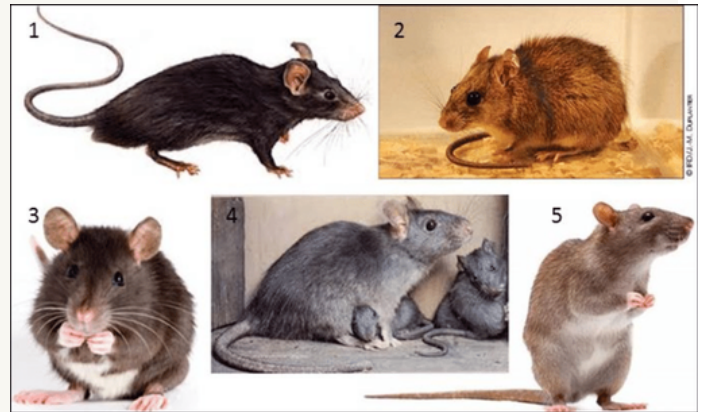
- The wounds caused by their spines on riparian inhabitants /farmers.

In Cameroon's arid Far North region in 2005, the crops were damaged by migratory locusts that invaded all the six divisions, eating any green leaves they encounter. That led to enormous damage, and fears of food shortages. In order to palliate to food shortage, some 2,000 tonnes of cereals had to be provided for the local populations.

b- Rodents

As for rodents, they are considered as the most abundant and diverse order of living mammals (~40% of mammalian biodiversity; [Burgin et al., 2018](#)) and are undoubtedly the most common non-domestic vertebrates to accompany humans in their global dispersal ([Cucchi et al., 2020](#)). Rodents have adapted to all lifestyles: terrestrial, aquatic, arboreal, and fossorial (underground) (Witmer & Shields 2018). Because of the continual growth of their incisors throughout their life span, constant gnawing is necessary to keep them sharp and at an appropriate length, thus leading to extensive damage to seeds, fruits, field crops, structures, wires, and insulation. Of the four rodents listed amongst the “100 of the world’s worst invasive alien species” ([Lowe et al., 2000](#); [Luque et al., 2014](#)), two are present in Cameroon: black rat *Rattus rattus*,

and house mouse *Mus domesticus* (Dobigny et al. 2011, Ihle et al., 2006). Native to a large portion of Asia, and through southern China, and the southern Europe, northern Africa, and Asia (Long 2003) respectively, the black rat and house mouse have been implicated in the decline and extinction of native biota. For example, through the consumption of some snail species, and small egg-species, reductions and alterations in socio-economic activities, including a role as disease reservoirs such as plague, scrub typhus, leptospirosis, salmonella, lymphocytic choriomeningitis, and haemorrhagic fevers (Witmer & Shields 2018, [Han et al., 2015](#), [Zhang et al., 2022](#)). Globally, at least US\$ 3.6 billion of loss have been reported between 1930 and 2022 to invasive rodents, with the cost in Africa approaching approximately US\$ 1 million ([Diagne et al., 2023](#)).



Rattus rattus

(1) <http://habugs.ca/rodents/noef-rat/>, (2) ? JRD / JM Duplantier, (3) www.centre-anti-parasitaires.fr/, (4) www.planet-mammiferes.org/, (5) <http://ajsppestcontrol.co.uk/>. Un meta-modèle multi-monde et multi-échelle pour la simulation à base d'agents de systèmes complexes présentant des phénomènes historiques et géographiques : Application à l'étude de la diffusion du rat noir au Sénégal. Thèse de Doctorat de Pape Adama M'houy



Mus musculus domesticus

from the German population. Photograph by Christine Pfeifle

II.1.2. Aquatic alien species

a-Fish

Introduced in most African countries for different purposes such as aquaculture development, biological control and capture, and sports fisheries, some of these fish have become invasive (Satia et al. 1997, Lazard & Leveque 2009, Stiassny et al. 2007). Among the invasive species recorded in Cameroon, can be listed the Nile tilapia (*Oreochromis niloticus*), the African catfishes (*Clarias gariepinus*), the African snakehead fish



Clarias gariepinus

FAO 2023. *Clarias gariepinus*. Cultured Aquatic Species Information Programme. 发文者 Pouamagne, V. 渔业及水产养殖业司 [在线的]. 罗马. [被引 Monday, June 19th 2023].

(*Parachanna obscura*), and *Tilapia cameronensis* (Breine et al. 1996, Monentcham 2009). They are characterized by large sizes, indicative probably of a rapid growth and thus the reasons of their uses in enhancing fish production in the world through aquaculture (Tiogue et al. 2018). According to the study conducted by Tiogue et al. (2018), alien freshwater fish species showed a monthly and seasonal fluctuation in abundance in number of individuals towards the rainy season and the mid-dry season for *Clarias gariepinus* or all seasons for other alien fishes (*O. niloticus*, *T. cameronensis*, and *P. Obscura*). This fluctuation suggests that the seasonal changes in the habitat probably favoured the growth and development of the species, hence the large number in the field at this period of the year.

Detrimental impacts of invasive fishes on ecosystems have been associated with mainly predation, food and habitat competition, hybridization, habitat degradations and disease transfer (Copp et al. 2005; Kennard et al. 2005). Indeed, because they may not have natural predators in their new environment, invasive fish can dramatically alter food web structures, decreasing the food available for native species. As a result, direct competition leads to population declines in native species and loss of biodiversity.

Invasive fish and invertebrates also pose a serious threat to recreational water activities, making it difficult and even dangerous to swim and boat.



Parachanna obscura

D. S. J. V. Vodounnou, D. N. Kpogbe, Y. Akpo, M. Taghika, E. Fiogbé (2017). Determination of sexual dimorphism of African snakehead (*Parachanna obscura*): morphometric and meristic parameters, weight-length relationship and condition factor. *International Journal of Biological and Chemical Sciences*. DOI:10.4314/IJBCS.V11I4.26

III–ALIEN PLANT SPECIES

Concerning the alien invasive plant, the focus will be on *chromolaena odorata* and *imperata cylindrical*, which are terrestrial plants, and on water hyacinth (*Pontederia crassipes*), water lettuce (*Pistia stratiotes*) and giant salvinia (*Salvinia molesta*) which are aquatic plants.

III.1. TERRESTRIAL PLANT SPECIES

a– *Imperata cylindrical*



Imperata cylindrical

Native to Cameroon ([Hutchinson et al. \(1972\)](#)), *Imperata cylindrical* (Poaceae) became a serious weed of intensive agriculture particularly in areas prone to recurrent burning. *Imperata cylindrical* (spear grass) is one of the 10 worst weeds in the tropics and subtropics, and among 100 of the "World's Worst" invaders by the IUCN Invasive [Species Specialist Group](#).

The negative impact of spear grass on agriculture includes severe crop yield losses and high investment in labour for weeding. Crop yield reduction attributable to competition from speargrass has been estimated at 76–80% in cassava, 78% in yam, and 50% in maize (Koch et al., 1990; Chikoye et al., 2000). Millions of hectares of farmland are abandoned because of *I. cylindrical* grass in West and Central Africa each year.

b- *Chromolaena odorata*



Chromolaena odorata

Native to tropical America, *Chromolaena odorata* was introduced to Cameroon from Nigeria in the early 1960s as a cover crop for cocoa (Ngobo et al. 2004) but also to reduce the impact of *I. Cylindrica*. Nowadays, the plant is an aggressive competitor with food crops almost everywhere in Cameroon, especially in southern Cameroon and is one of the dominant weed and fallow species in slash-and-burn farming areas (Ngobo et al. 2004). It is a major weed in plantations and croplands, including plantations of rubber, oil palm, forestry and coffee plants. Where it is found, it forms dense stands preventing establishment of other species, both due to competition and allelopathic effects.

III.2. AQUATIC SPECIES

Among the main aquatic invasive species that have invaded water bodies in the world at present, and of the five that are particularly problematic in Africa, three are present in Cameroon namely: *Pontederia crassipes* (water hyacinth), *Pistia stratiotes* (water lettuce) present in Cameroon for half a century and *Salvinia molesta* which has been recorded for ten years now (Kenfack, 2017, Kenfack unpub.).

Whether it is water hyacinth or giant salvinia, their rapid growth has led to the extinction of certain plant and animal species. Infestations reduce light in the river and also reduce oxygen. During our investigations in the infested environments, the riverside communities revealed that before the appearance of both species, the fish production of the river was important, but with their presence, some plants have disappeared including medicinal ones, while the quantity of fish has decreased and, in some areas, crustaceans have disappeared too.

The impact of water hyacinth on health has also been studied. As mentioned earlier, water hyacinth mats are a breeding ground for disease vectors like mosquitoes that cause malaria, lymphatic filariasis, and snails that cause bilharzia (schistosomiasis) (Kenfack 2017).

Whether aquatic or terrestrial, the specificity of these weeds is that they form monospecific mat that do not allow other species to thrive.

IV-CONCLUSION

In view of the ongoing, including the socio-economic and health impacts on sites infested by invasive species, it becomes mandatory to promote appropriate measures to reduce the spread of the invasives and thus ensure the stability and health of the environment.

As suggested by Reaser et al. (2007) and Binimelis et al. (2006), any plan for the management or control of invasive species must take into account the potential impacts of the proposed actions and the people who depend on them.

By so doing, the study or the control will not only be the duty of a scientist, but everyone's business.

In this way, each person has the responsibility to avoid introducing or spreading invasive species.

According to the United Nations Convention on Biological Diversity (CBD), biodiversity or "Biological diversity" means the variability among living organisms from all sources – including terrestrial, marine and other aquatic ecosystems and ecological complexes of which they are part.

The benefits of this biodiversity are enormous in terms of health, food, culture and economy, as well as in sustaining life on earth. Biodiversity is at the centre of many economic activities, particularly those related to crop and livestock agriculture, forestry, and fisheries. Globally, nearly half of the human population is directly dependent on natural resources for its livelihood, and many of the most vulnerable people depend directly on biodiversity to fulfil their daily subsistence needs.

However, due to many factors, the risk of species' extinction is increasing at an unprecedented rate in the history of humanity with a deterioration of 9.2% between 2000 and 2022, as presented by the IUCN Redlist of threatened species which measures the overall risk of species extinction (<https://www.iucnredlist.org/>). As stated above, invasive species alter the biodiversity and thus hinders it to play its essential role in achieving the Sustainable Development Goals. Among the sustainable development goals most affected by invasive species can be mentioned the SDG 2 – End hunger, achieve food security and improved nutrition; promote sustainable agriculture , SDG 6 – Ensure the availability and sustainable management of water and sanitation for all, SDG 14 – Conserve and sustainably use the oceans, seas and marine resources for sustainable development, and SDG 15 – Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification and halt and reverse land degradation and halt biodiversity loss.

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