# INTRODUCTION

No living organism lives in isolation. Organisms interact with each other and the biological, physical and chemical components of the environment, where they derive their food and other means of sustenance. This invariably affects them negatively or positively. This science of the interaction is called **ECOLOGY.** (Anyanwu *et al*, 2014). Ecology refers to the inter relationship of living organisms and their environments.

Invasive species have been a major ecological threat as it affects the natural diversity of a place and displaces indigenous species. Invasive species or exotic species are species that are not originally grown or found in an area but are introduced by one means or another especially through transportation (ballast water) trade, tourists or even missionaries (as with the case in most species). This species have specially modified parts for survival and adaptation to new environments. They also have the ability to either hibernate or aestivate during unfavorable conditions.

The interaction of invasive species have a lot of effects on the environment (biotic and abiotic components) and this paper seeks to cover this effects on a few common selected species.

# CHAPTER ONE

## NYPA PALM *(NYPA FRUTICANS)*

### Classification

| | |
|---|---|
| Kingdom | Plantae |
| Phylum | Spermatophyte |
| Subphylum | Andiospermae |
| Class | Monocotyledonae |
| Order | Arecales |
| Family | Arecaceae |
| Genus | Nypa |
| Species | *Nypa fruticans* |

### History/Mode of Introduction.

The nipa palm occupies a unique position in the palmae. It is considered an advanced palm species with a very long history. Possible relations with the genera pandanus and sararanga (both from the paradanaceae) have been

suggested. Nipa was introduced into west Africa in the early 1900s specifically Oron 4.8°N 8.2°E Nigeria in 1906 and Calabar Nigeria in 1012. (Hutchinson and Dalziel, 1912). It has now spread westwards along the coast down to latitude 4°E. by the early 1990s, Nipa had been recognized as a serious invasive weed. (king, 199). Other oral sources relate that nipa was introduced to check coastal erosions and that it enjoyed total protection /by law. There are anecdotal accounts from Nigeria that people were prosecuted and imprisoned by the colonial administration for as much as cutting a frond of the palm.

The plant spreads mainly through its fruits floating on ocean tides and currents to new locations. Tidal movement is largely responsible for its infestation in the Niger Delta. However, there is a real danger of people carrying the fruits while on a casual visit to the beach and then dropping them at other susceptible sites. The probability of intentional introduction as an ornamental plant is also very high.

**Habitat**

It is a tropical plant. The average minimum temperature in its growing areas is 20°C and maximum temperature is 32-35°C. its optimum climate is sub humid to humid with than 100mm rainfall monthly throughout the year. It thrives majorly in brackish water environment and is rarely seen directly on the seashore.

Optimum conditions are when the base and rhizome of the palm are inundated by brackish water. For this reason, nipa palm occupies estuarine tidal flood plains of rivers. The optimum concentration 1-9 per mil. Nipa palm swamp soils are mildly rich in alluvial silt, clay and humus.

## Impacts of The Nipa Palm

1. It impacts negatively on fish catch and shell fish collection.
2. It also impacts negatively on rural navigation in coastal waters.
3. It threatened Nigeria's extensive mangrove vegetation by displacing the mangrove stands and establishing itself in a mono specific manner.
4. It reduces the potential for natural mechanisms for control of coastal soil erosion and causes general conversion and biodiversity loss with attendant reduction in biological production potentials of the ecosystem.
5. Being prostrate and gregarious, Nipa outcompetes other woody mangrove species. This leads to a loss in biodiversity/
6. Loss of biodiversity due to invasion of plants such as nipa forces migration and the search for new livelihoods thereby distorting the social structure of the communities.
7. It negatively impacts tourism
8. It causes an ecosystem change and habitat alteration. It also reduces

amenity values.

## Uses of The Nipa Palm

1. Palm sap can be obtained by tapping the inflorescence stalks as a source of treacle amorphous sugar, alcohol or vinegar. This fermented sap is locally called toddy (native to South East Asia).
2. The long pinnate leaves (fronds) provide material for thatching houses.
3. The leaflets and midribs are used for manufacturing of brooms, baskets, mats and sunhats.
4. Various parts of the nipa palm are a source of medicine. An example is using the juice from young shoots to cure or fight against herpes.
5. Nipa fronds are commonly used as sails by local fishermen.
6. It is also used as fuels, and food additives.
7. It is a good source of wood ware.

## Prevention/ Control Measures

- **Cultural Control**: In Nigeria, no cultural control has been attempted.
- **Mechanical Control:** This involves repeated cutting which has proven successful in the Niger Delta, Nigeria. Plant fronds are cut back 3 times. Recommended period between each cutting is 6 weeks for maximum

effectiveness. Machetes and chain saws are used for cutting.

- **Chemical Control**: This is not encouraged because of the pollution the chemicals can cause in the water.
- **Biological Control:** There are no know natural enemies in West Africa.

# CHAPTER TWO

## COMMON HOUSE GECKO (*HEMIDACTYLUS FRENATUS*)

### Classification

| | |
|---|---|
| Kingdom | Animalia |
| Phylum | Chordata |
| Sub Phylum | Vertebrata |
| Class | Reptilian |
| Order | Squamata |
| Family | Gekkonidae |
| Genus | Hemidactylus |
| Species | *Hemidactylus frenatus* |

### History/Mode of Introduction

The common house gecko whose original natural range is Asia and the Indopacific is now established in at least 87 locations around the world. It has been shown that habitat simplification and dumped food resources around

artificial light sources as a result of urbanization have enabled the common house gecko gain an indirect competitive advantage over their nocturnal gecko species. It was also able to spread due to its adaptability and ability to crawl around on rotting woods. It has been accidentally introduced to many tropical and sub-tropical places around the world via cargo shipment and as commercial feeder food for zoo and pet animals. There are no concrete records as to when it was introduced to West Africa but a rough estimate has it that it was introduced to Africa in the1800s.

## Habitat

It is found from sea level up to 1600m altitude (Spanus *et al*,2002), in rain forests, savannahs, deserts and urban areas. It is an arboreal and nocturnal lizard species mostly domestically observed in building walls. It also occurs on boulders, trees, under rocks or rotting logs. (Ota & Whitaker, 2010). H. *frenatus* is edificarian and typically found in association with human dwellings. It is not a major fan of temperatures below 17°C as it cannot digest food at that temperature hence feeding stops. Under proper conditions, it reproduces all year round with females laying 1-2 eggs.

## Ecological Impacts of the Common House Gecko

1. It has high ecto parasite and endo parasite loads and can act as vectors by transmission to native gecko species and provide a zoonotic pathway to affects human health.
2. It displaces native Indopacific H. *garnotilis* (Dame & Petren, 2006) and mourning geckos, *lepidodactylus lugbris*, (Case *et al,* 1994) and the decline in extinction of native and endemic night geckos.
3. It increases vulnerability to invasions.
4. It negatively impacts human and animal health.
5. Reduces native biodiversity.
6. It monopolizes resources, through predation and pathogenesis.
7. It is easily introduced as it is difficult to detect as a commodity contaminant or in the field.

## Uses of The Common House Gecko

1. It is used as a food source for animals in zoos and other pet trade
2. It can be used for bioassays in the lab and also as a research model due to its high genetic variability and relatively long life span in captivity (up to 5

years)

## Prevention/Control Measures

- SPS Measures- Since majority of introductions occurred accidentally as stow ways in cargo shipments, thorough searching of boxes and plants might reduce the number of future introductions to new areas. Cole *et al* (2005) suggested that the use of artificial refagia made up of a crumbly substrate may limit future disturbances.
- Eradication – once established, it is unlikely to be eradicated.

# CHAPTER THREE

## BROWN RAT *(RATTUS NOVERGICUS)*

### Classification

| | |
|---|---|
| Kingdom | Animalia |
| Phylum | Chordata |
| Sub Phylum | Vertebrata |
| Class | Mammalian |
| Order | Rodentia |
| Family | Muridae |
| Genus | Rattus |
| Specie | *Rattus Novergicus* |

### History/Mode of Introduction

The brown rat originated in Asia. It arrived in North America via Europe in the 18th century. The species was originally native to south Siberia, North East China and parts of Japan but it occurs worldwide aa an introduced specie. Records of

when they were introduced to Nigeria are unknown but it is speculated that they were introduced through shipments of cargos.

## Habitat

The brown rat is a highly adaptable specie and can inhabit a wide range of environments, particularly in association with humans. However, brown rats tend to be more common in cooler climates, and in tropical regions are usually restricted to human modified environments such as buildings and ports. They can also be found in farms, particularly those where they can find grain to eat. They are also fixtures within hedgerows, streams, woodlands and fields that have ample crops.

## Impacts of The Brown Rat

1. It has caused or contributed to the extinction or range reduction of native mammals, reptiles and invertebrates through predation and competition.
2. It restricts the generation of many plant species by eating seeds and seedlings. Eats food crops and spoils human food stores by urinating and defecating in them.
3. They transmit the plague bacterium *Yersinia pestis* via fleas in certain areas of the world. They are major carriers of pathogens including,

*Coxiella burnetti, Toxoplasma gondii, Trichenella*, etc.

4. It has high reproductive potential and so spreads over a place really quickly causing a lot of damage.

## Uses of The Brown Rat.

1. It is primarily used in laboratory research in an inbred albino form. The wide spread use of this specie as a research model does provide insight for scientists working on an invasive wild form.
2. It is also a common house pet.
3. In developing nations, it may be captured for crop protection and may be eaten as supplementary or famine food.

## Prevention/ Control Measures

- **Preventative measures**: It is better and easier preventing rodents from entering into a new location in the first place. Eliminating a single invading rat can be disproportionately difficult.
- **Physical control**: Trapping is often used on a local scale for control around farms, crops and small wild life areas; however, it generally fails to remove all individuals, as a trap shy animal can survive and re populate.

- **Chemical control:** The use of anticoagulant poisons is the most common

method of control and eradication. anticoagulant poisons can be bought over the counter in most countries and used for local scale control to medium sized controls.

- **Biological control**: Contraceptive methods of control are currently experimental, but the potential for effective control using contraceptive method is promising.

# CHAPTER FOUR

## WATER HYACINTH (*EICHHORNIA CRASSIPES*)

### Classification

| | |
|---|---|
| Kingdom | Plantae |
| Phylum | Spermatophyta |
| Subphylum | Angiospermae |
| Class | Monocotyledonae |
| Order | Pontederiales |
| Family | Pontederiaceae |
| Genus | Eichhornia |
| Species | *Eichhornia crassipes* |

### History/Mode of Introduction

Originally from South America, water hyacinth, *Eichhornia crassipes* (Mart.) is one of the world's most prevalent invasive aquatic plants. Water hyacinth, a floating vascular plant, is known to cause major ecological and socio-economic

changes (Center, 1994). Water hyacinth has invaded freshwater systems in over 50 countries on five continents; it is especially pervasive throughout Southeast Asia, the southeastern United States, central and western Africa, and Central America (Bartodziej & Weymouth, 1995; Brendonck *et al.,* 2003; Lu *et al.,* 2007; Martinez Jimenez & Gomez Balandra, 2007). It is prevalent in tropical and subtropical water bodies where nutrient levels are often high due to agricultural runoff, deforestation, and insufficient wastewater treatment. There is not a clear record of how, why, and when water hyacinth was introduced to water bodies outside of its native range, but many populations are well established and persistent despite control efforts.

## Impacts of The Water Hyacinth

1. Water hyacinth can change water quality by altering water clarity and decreasing phytoplankton production, dissolved oxygen, nitrogen, phosphorous, heavy metals, and other contaminant concentrations.
2. Water hyacinth has mixed effects on zooplankton abundance and diversity. Zooplankton abundance tends to decrease in response to decreased phytoplankton availability, but populations may increase in response to increased refuge from predators.
3. Photosynthesis is limited beneath water hyacinth mats, and the plant itself

does not release oxygen into the water as do phytoplankton and submerged vegetation (Meerhoff *et al.*, 2003), resulting in decreased dissolved oxygen concentration.

4. It also affects the temperature of the water and prevents light penetration.
5. It outcompetes submersed phytoplankton and macrophytes. Because it is free floating, it monopolizes the light and nutrient from water columns, this in turn affects zooplankton productivity.
6. They change the diets of fishes through prey availability. Their mats can reduce natural predation and fisheries catchability and reduce breeding, nursery and feeding grounds.
7. It affects boating access, navigability and recreation and pipe systems for agriculture, industry and municipal water supply.

## Uses of The Water Hyacinth

1. In Songhai farm in rivers state, they are used to reduce the smell of feaces in the holding pits while they are being converted to gas for domestic and industrial purposes.
2. It acts as a substrate for macroinvertebrates like the snails and arachnids.
3. The mats (roots) of the water hyacinth could be used for local craft work like making of mats, hats, baskets etc.

4. In polluted waters, it helps reduce heavy metal concentration by absorbing these metals from the water.
5. Water hyacinth also has been found to stabilize pH levels and temperature in experimental lagoons, thereby preventing stratification and increasing mixing within the water column.

## Preventive/ Control Methods

- **Mechanical control:** Options include harvesting plants and in-site cutting. There are several advantages and disadvantages to implementing a mechanical control strategy depending on the option chosen. In general, there are no water-use restrictions associated with mechanical control and it does not require much technical expertise. Mechanical control immediately opens physical space (habitat) for fish, boat traffic, fishing, and recreation. In-situ cutting, where plants are left to die and decompose in the water, can decrease dissolved oxygen and alter trophic structure as result of changes in nutrient and carbon balances (Scheffer *et al.*, 1993; Greenfield *et al.*, 2007).
- **Chemical Control**: Chemical control plans have been introduced in several locations worldwide; Glyphosate (Roundup), Diquat, and 2, 4-D amine are common herbicides used on water hyacinth (Seagrave, 1988; Gutierrez *et*

*al.,* 1994; Lugo *et al.,* 1998). Chemical control plans are considered less labor intensive and less expensive than mechanical control, especially at large scales (Guitierrez-Lopez 1993). Although chemical control plans can cover large areas in short time periods, herbicides can become expensive if management requires repeated applications. The cost of the chemical plan will depend heavily on the equipment used to administer the herbicide (e.g. backpack sprayer, helicopter, or airboat). Spraying large areas within a short time span can cause dangerous deoxygenation of water (Lugo *et al.*, 1998). Herbicides are less selective than mechanical or manual approaches and can kill non-target algae and macrophytes (Seagrave,1988), resulting in far reaching ecological impacts (Richards *et al.,* 1985; Arora & Mehra, 2003; Rocha-Ramirez *et al.,* 2007). The herbicide should be sprayed directly onto the leaves of water hyacinth to avoid killing algae in the water column (Seagrave, 1988).

- **Biological control:** Biological control is an attractive alternative to mechanical and chemical control programmes because it avoids the introduction of toxic chemicals, it is not labor or equipment intensive, and it has the potential to be self-sustaining if the introduced biological agent can reproduce successfully in the new environment without causing further ecological effects (Seagrave, 1988). Much of the cost of biological

control programmes is on the front end, mainly related to research and development. Biological controls are often viewed as a long-term, sustainable solution to water hyacinth control. Host specificity is critical to any successful biological control programme. Ideally, the introduced agent will have a narrow range of requirements to keep the effects focused on the target plant but broad enough to maintain a viable population when the host plant is in low densities. Common biological control options for water hyacinth include various insect species and introduced plant pathogens (Coetzee et al., 2007). *Neochetina eichhorniae* and *N. bruchi* are two commonly used weevil species from the plant's native range (Sosa *et al.*, 2007).

# CONCLUSION

It is true that invasive species are almost impossible to control or eradicate once introduced into a place. But great care should be taken when things or people are being moved from one place to another to avoid the introduction of non-indigenous species. Most of our native species have gone into extinction due to high completion levels from these introduced species leading to a decline in the ecosystem diversity.

Exotic species are not limited to only plants and animals but also include microorganisms too. They pose serious threats which are not only ecological but also social economical and can even reduce a country's international relationship with other countries.

Nevertheless, they have their advantages and the best thing that can be done with these species is to utilize their potentials effectively for the greater good of the ecosystem.

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