Some alien invasive wetland species have been introduced as decorative plants and animals, for horticulture and the aquarium and fisheries industries. Some are kept for decoration and even spread further for the same reason! Water hyacinth is seen here decorating a fountain.

G.W. Howard
S.W. Matindi
TERMS RELATED TO ALIEN INVASIVE SPECIES

ALIEN - Exotic, non-indigenous, coming from outside a given area.
NATIVE/INDIGENOUS - Originating from the area in question.
INVASIVE SPECIES - An organism that expands its population rapidly to the demise of local species, ecosystems, development and even human health.
PATHWAY - The route or means by which an invasive species comes to an area.
CONTROL - The management of an invasive species, weed or pest to tolerable levels.
ERADICATION - Complete removal of an invasive species, weed or pest such that it does not recur.

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Photos were taken by the authors except for the Common Carp (kindly donated by Luc DeVos), Azolla (thanks to Kelly West) and Mimosa in the Chunga Lagoon (Bob Douthwaite).

Cover Photo: Pistia invading a freshwater lake on the floodplain of the lower Rufiji River in Tanzania

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INVASIVE ALIEN SPECIES IN WETLANDS IN AFRICA

Wetlands in Africa are increasingly being recognised as ecosystems of extreme importance to man and biodiversity. People derive many benefits from the goods and services provided by wetlands while wetland systems are the “homes” of very many species of animals and plants and their habitats. In Africa wetland awareness has been paralleled by the need to develop mechanisms for tropical wetland management - both to maintain the human benefits from wetlands and to secure their biodiversity into the future.

Management of African wetlands, as well as lakes and rivers, however, has been impacted by alien invasive species that specialise on aquatic (and semi-aquatic) systems and which cause damage to their human benefits and their biodiversity. These are species that come from “outside” and which arrive without their native controls - such as their own competitors, predators, parasites and pathogens. They are species which grow fast, spread quickly and cause all manner of problems in their “new” ecosystems. These aliens can be plants, animals or micro-organisms, they can be introduced to Africa intentionally or unintentionally, but nevertheless spread and cause problems wherever they establish and become invasive. In this case “invasiveness” usually means over-running local ecosystems and habitats, species and communities, human development and infrastructure. The damage caused by alien invasive species to African wetlands runs into the billions of dollars annually - but hard data is hard to acquire as the impacts of these species are only just being realised. Most well-known would be the Water Hyacinth - sometimes called “the world’s worst water weed” - which has inflicted many millions of dollars of damage to Africa’s wetlands, lakes, rivers, hydro-schemes, irrigation and water supply systems, fisheries and human welfare - not to mention its effects on Africa’s aquatic biodiversity! And then there are the huge costs of control, to manage the invasive species and then to try restore the affected ecosystems to their previous condition - these also run into many millions of dollars per year continent-wide.

The Ramsar Convention on Wetlands of International Importance together with the Global Invasive Species Programme and IUCN - The World Conservation Union, have taken these matters to heart and, together, are promoting an understanding of wetland invasives - both from the aspect of biodiversity conservation and of human welfare. A first step is to raise the awareness of the people concerned (wetland residents, wetland managers, water managers, energy managers, irrigation managers, etc.) of the existence of alien invasive species already in Africa’s wetlands and then the threats they pose in existing and future invasions. It is also necessary to provide some information on their identity, possibilities for control and sources of available information and technical assistance. Wetland invaders can rarely be eradicated, but they can usually be controlled if efforts to prevent their arrival have failed and if they have become established. Control is always expensive and time-consuming but can result in lasting ecosystem integrity.

Many of the organisms that invade wetlands in Africa also have their traditional and new uses. Plants are often used for fibre, building materials, energy, mulch and stockfeed. Aquatic animals like fish and some crustaceans become invasive when introduced to enhance fisheries – where they become very valuable. But it should be noted that uses of alien invasive species, however diverse, will not alone result in their control.

This booklet introduces alien wetland invaders by describing seven of the worst already introduced to Africa while mentioning others that “are coming”. It also tries to distinguish between alien invasive species and those native species that also cause problems - with examples of two that affect African wetlands - although there are many others. But primarily this publication is intended to bring to peoples’ attention the existence and threats of alien invasive species generally, and those that affect aquatic ecosystems in Africa in particular.
**EICHHORNIA CRASSIPES**

**Common Name:** Water Hyacinth

**Description:** An exotic, free-floating aquatic plant with shiny, dark green, upper parts and a brilliant blue-purple flower with yellow markings. The leaves have expanded, hollow stems that enhance its ability to float and can extend to 2 m above the water level. The submerged roots (rhizoids) are relatively long and “feathery”, extending as much as 1 m below the water. It reproduces through flowers and seeds (which can remain viable for up to 15 years) and by vegetative propagation from its stolons.

**Habitat:** Water hyacinth is found in dams, lakes, swamps and riverine wetlands throughout the main drainage systems of Africa. It barely survives in water with little nutrients but can grow to its full extent when supplied with dissolved salts and when it is in its optimum range of temperature (25°C) and high humidity (up to 90% RH). The hyacinth often flowers profusely in shallow waters where it may become rooted in soil and can leave many seeds in that medium - which geminate with changing water levels over subsequent years.

**Origin:** Amazon River Basin, South America.

**Impacts:** *E. crassipes* can form small colonies, “floating islands” or extensive mats that can cover thousands of hectares of previously open water. When invasive, water hyacinth forms a complete covering of the water surface that excludes most light and air for submerged organisms thus depriving them of essentials for survival. A significant reduction of general aquatic biodiversity and a change of fisheries results. The mats have serious mechanical impacts on water supply systems, drainage canals, inflows to hydropower generators, movement of shipping and river flows. The hyacinth also increases evapotranspiration well above that of open water and causes significant water loss to reservoirs and wild waters. The crowding of plants at the edges of water bodies prevents peoples’ access to the water for, e.g., collecting water and fishing as well as access of fishing boats. Invasive water hyacinth often forms mats upon which other wetland plants can grow and where disease vectors and vermin are often a threat to local communities adjoining wetlands. The costs of water hyacinth invasion is often in millions of dollars and its control is expensive and time-consuming.

**Pathway:** *E. crassipes* has been introduced to Africa many times as an ornamental and has now spread to most of the major water systems (rivers, lakes and wetlands) of the continent. While widespread, it tends only to become invasive when there is some alteration to a water system such as the introduction of nutrients or the modification of flows.

**Management/Control:** Water hyacinth can be controlled by mechanical means (using manpower and machines) but this is mostly unsuccessful as the plant grows faster than mechanical clearance can keep up. Various herbicides are effective but have significant risks for other wetland biodiversity. Most successful and self-sustaining is biological control using two beetles (the weevils *Neochetina eichorniae* and *N. bruchi*) and other species such as a moth, a mite and pathogenic fungi. Biocontrol alone, however, is not always effective and there are often good reasons for using integrated control involving mechanical and chemical control as well.
AZOLLA FILICULOIDES

Common Name: Red water fern, Azolla.

Description: A small, free-floating aquatic fern with horizontal stems up to 3 cm. The leaves are pale green to red-brown arranged in an alternate branched pattern*. Beneath the leaves there are unbranched rootlets which “dangle” down in the water and keep the plant surface upwards. It has minute fruiting bodies that produce highly dispersable spores, but it mainly propagates vegetatively and is able to regenerate from any small fragment as long as it includes a growing point.

Habitat Azolla is found in irrigation systems, in ponds and dams, in sheltered parts of reservoirs and lakes and amongst other aquatic plants in slow-moving streams, rivers and wetlands.

Origin: South America (Argentina, Brazil, Uruguay and Peru).

Impacts: Azolla forms mats on the water surface that can block irrigation channels and waterways, increase water loss and interfere with boating and fishing. The mats can provide a haven for mosquito larvae and bilharzia carrying snails while preventing light from reaching submerged biodiversity.

Pathway: Easily spread by birds and mammals, between water systems and irrigation areas; it can also be spread unintentionally by people - on shoes and on vehicles. Azolla can be carried by wind and water currents - both as spores and as vegetative fragments.

Management/Control: The most effective control for Azolla is by mechanical removal from the water surface - which is often aided by its value as a “mulch” for agricultural crops and vegetable gardens. Biocontrol has been effected (e.g. in South Africa) using leaf-eating insects: a flea beetle (Pseudolampsis guttata) and a weevil (Stenopelmus rufinasus).

Note, however, that Azolla harbours a symbiotic blue-green alga (Anabaena azollae) which fixes nitrogen from its surroundings and so give this invasive fern a value as a provider of nitrogen when allowed to grow with paddy rice and other semi-aquatic foodplants.

*Note: There is a common, native Azolla species in Africa, A. pinnata, which is darker green and distinguishable by the pinnate branching of its stems - it can become a weed but tends not to be invasive.
PISTIA STRATIOTES

**Common Name:** Water lettuce, Nile cabbage

**Description:** A free-floating aquatic plant with a rosette of pale-green leaves and a tuft of relatively long, fibrous roots below. Individual plants of *P. stratiotes* can range in size from as small as 2cm up to 30cm in diameter and range in colour from dark green to pale yellow-green - depending upon the supply of nutrients in the water. Plants may be found floating singly or in small groups or large mats - on open water or partly "stranded" on the margins of a water body or wetland.

**Habitat:** *P. stratiotes* is found in ponds, dams, lakes, rivers and a range of permanent and seasonal wetlands. It often grows and expands in pools and wetlands associated with river systems and then is released into the main river channel when the river rises in its flood season.

**Origin:** Widespread in the tropics and sub-tropics but probably originating in South America; some authors suggest that it is native to Africa, others that it has become “naturalised”. Nevertheless it can become invasive in the true sense of that word.

**Impacts:** *P. stratiotes* can form thick and extensive mats that can block both sunlight and air from reaching a water surface and so have impacts on aquatic biodiversity and fisheries. Water lettuce can accumulate at barriers in flowing water and cause damage or blockage to, e.g., irrigation canals and inlets to hydropower installations. It can grow together with Water Hyacinth and Salvinia to worsen the effects of both.

**Pathway:** Water lettuce is spread along water systems by flow and wind and can be moved by aquatic animals (hippos, other marsh mammals, waterbirds) and human visitors to infested waters. Pistia is also moved on boats and wheeled vehicles that have come into contact with infested waters. It is widespread in African water systems at relatively low density but can grow quickly and form mats when the necessary nutrients are available - and in this way can become invasive.

**Management/Control:** Pistia can be controlled by the mechanical removal of plants - but care must be taken that they are not re-introduced to the water system. Chemical control has been used and 2,4-D, a herbicide is quite effective - except for the obvious impacts on non-target species in wetlands and water bodies. Biological control using beetles (especially the weevil *Neohydronomous affinis*) has been effective in tropical situations. As with other floating aquatic weeds, however, care taken with the watershed to reduce nutrient input to wetlands is the most effective method of control - although expensive and not always possible.

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**Notes:**

- Pistia covering most of a dam in a dry area
- Pistia spreads across a lagoon
SALVINIA MOLESTA

**Common Name:** Water fern, Kariba weed

**Description:** A small, perennial, free-floating, aquatic fern with horizontal stems and tightly overlapping leaves. The leaves are green to yellow-green and are covered with course hairs which trap air bubbles and keep the plant afloat. The surface above the water is unwettable while submerged leaves have hairs resembling roots. Salvinia propagates only vegetatively and is able to regenerate from any small fragment as long as it includes a growing point.

*S. molesta* differs from other African species of *Salvinia* by its empty (sterile) sporocarps and its paler green colour. Other species are not regarded as weeds.

**Habitat** *Salvinia molesta* is found in the slow-moving edges of rivers and streams, in dams, ponds and lakes and in wetlands such as reed and sedge swamps.

**Origin:** Brazil, South America.

**Impacts:** Invasive Salvinia forms mats that can cover water surfaces and expand at an alarming rate (being able to double its surface area in a few days when conditions are optimum). It can completely cover a small water body so that light and air are unavailable to submerged organisms - with consequent damage to fisheries and biodiversity. It can prevent peoples’ access to open water and slow down or prevent water transport; mechanical blockage of waterways, irrigation canals and inlets to water supply and hydropower facilities are all recorded as being caused by Salvinia. Other water plants can use Salvinia as a substrate so that a floating “sudd” or complex of wetland vegetation can form which further enhances the deleterious effects.

**Pathway:** *S. molesta* can be spread by water currents, by birds and mammals, by boats and vehicles that enter infested waters. It can grow from small fragments and so has been spread to most water systems within Africa - but it only becomes invasive under a range of (mostly artificial) conditions - including alteration of flows and increases of nutrients as a result of dams, diversions and improper use of agricultural chemicals in a watershed.

**Management/Control:** Salvinia can be physically removed from a waterbody (by mechanical or human means) but it grows so fast that this is often not effective - even when the extracted plants are used for mulch. Herbicides (such as 2,4-D, Glyphosphate, Diquat) can be used to control Salvinia but there is always a risk of affecting non-target organisms and of missing some plants which will re-infest the wetland concerned - rendering this method unsustainable. Biological control has proved effective and sustainable using the host-specific weevil *Cyrtobagous salviniae*. Integrated control combining biocontrol and chemical or mechanical methods with reduction of nutrients from agriculture, sewage and urban runoff is the most successful of all.
MIMOSA PIGRA

Common Name: Giant sensitive plant

Description: *Mimosa pigra* is a prickly leguminous shrub that can reach up to 5m in height. It has long brown woody stems that branch from the base and which bear many sharp thorns. The soft, green, finely bipinnate leaves fold inwards when the plant is disturbed by touch - hence the name “sensitive plant”. The flowers are “balls” of stamens usually pink or mauve, sometimes almost yellow in colour. The fruits are clustered pods with a “hairy” coating of small spines; these break up into small sections when they are mature. There are several other species of *Mimosa* (sensitive plants) in Africa, including the exotic *M. pudica* (which is smaller, hardly woody with soft stems and which is considered a “weed” of agricultural areas) - but *M. pigra* is the most robust and by far the most destructive - especially in disturbed areas.

Habitat: *Mimosa pigra* is a shrub of river banks, seasonal wetlands and shallow waters as it is tolerant of inundation. Once it has become invasive, it can occupy river valleys and floodplains and crowd the edges of lakes and wetlands.

Origin: South and Central America; it has been recorded in parts of Africa for two centuries and is becoming “naturalised” although it can also become invasive - especially when its browsers are removed or it is subject to unusual flooding.

Impacts: *Mimosa pigra* is known to cause extensive damage to local vegetation and other biodiversity by becoming a thicket of one species alone, smothering other plants and preventing access to both wild and domestic animals. In this way it can diminish grazing lands, especially floodplains, and reduce habitat diversity for wild animals and plants. It can block waterways with impacts on transport and fisheries and prevent peoples’ access to both aquatic and terrestrial habitats.

Pathway: *M. pigra* is spread most effectively through the seedpods which adhere to clothing, coats of mammals, birds and vehicle tyres. The pods will also float long distances, especially on an advancing flood.

Management/Control: The best control of *M. pigra* is to detect its spread and remove it mechanically before it establishes a thicket. Once established, mechanical control of *M. pigra* is extremely difficult as it readily sprouts new shoots after burning or bulldozing. Some herbicides are slightly effective but difficult to apply to extensive thickets that sometimes cover hundreds of hectares. Biological control is still being tested - mainly in Australia - using insects (seed predators, flower feeders and stem borers) and pathogenic fungi - but complete success is yet to be attained. In some countries in Asia the plant is used for firewood - but its prickly nature and impenetrable thickets make this unlikely to be a sustainable method of control.

Classification: 
**Dicotyledonae**  
**Leguminosae**  
**Mimosoidea**

Mimosa pigra spreads around a floodplain lagoon where previously there was only grass
PROCAMBARUS CLARKII

Common Name: Lousiana Crayfish

Description: A robust freshwater crustacean which has become invasive in African wetlands. *P. clarkii* is up to 15 cm long from the front of the body (rostrum) to the tip of the outstretched "tail". Adults are dark red-brown in colour and have two impressive chelae or claws extending as much as 10 cm from below the front part of the body covering, with which they manipulate their prey - as well as using them for defence. They have four other pairs of "legs" (with small, terminal, clasping chelae) and an expandable "tail" which is used for rapid backward propulsion in water.

Habits: The crayfish feed on submerged and emergent water plants, on semi-aquatic vegetation and on snails, other crustaceans and small fish. They often dig "burrows" in the banks or edges of water bodies. After mating, the females carry their eggs on the underside of their bodies until they hatch into larvae which are smaller versions of the adults.

Habitat: The Louisiana crayfish is found in natural and man-made wetlands (dams, reservoirs, farm ponds, swamps, lakes and floodplains), in shallow water and on the edges of deeper water bodies.

Origin: Southern United States of America; since spread to Europe and Africa.

Impacts: *Procambarus clarkii* can destroy native wetland vegetation and the snail and crustacean fauna of aquatic ecosystems. It has been held responsible for the disappearance of water lilies and submerged vegetation as well as many species of snails in wetlands of Eastern and Southern Africa where it has become invasive. It is possibly a threat to the existence of smaller fish of biodiversity value. Its habit of burrowing can result in damage to dams and reservoirs.

Pathway: In a few cases, *P. clarkii* was introduced to man-made wetlands to control bilharzia snails from where it spread to other wetlands. It was introduced to some water bodies to enhance fisheries and has also escaped from aquaculture where it is bred to provide a specialty food. As it is an "air-breather", the adults can travel long distances across land (especially in damp grass) and so spread from one wetland to another.

Management/Control: These crayfish are extremely difficult to control and while predatory fish have been tried, none has been very successful. The use of reproductive hormones in small water bodies is being tested, but otherwise only drainage and physical removal have been effective. The crayfish should, however, be prevented from spreading from one drainage basin to another as they have the potential to cause local extinctions - especially of molluscs, crustaceans and small fish (like killifish and the precious cichlids of the Great Lakes).
**Common Name:** Common Carp, Mirror Carp

**Description:** A relatively large, slender freshwater fish that can grow to as long as 80 cm and weigh as much as 20kg. The dorsal fin is quite long and the mouth is protrusible with a single pair of barbels. The body colour varies from greenish-brown to yellow-gold while the fins are dark grey.

**Habitat:** Established in many fish farms, Common Carp are found in farm dams, reservoirs, lakes and slow-flowing rivers as well as wetlands such as reed swamps attached to open water bodies.

**Origin:** Originating from Asia and Eastern Europe, this fish is so effective in aquaculture that it has been spread around the world for centuries and may have been introduced to Africa more than two hundred years ago. Many hatcheries in Africa supply fry of the Common Carp to fish farmers as they are popular in subsistence fishponds as well as commercial situations.

**Impacts:** Common carp cause many problems primarily because of their destructive feeding habits. These can result in loss of local species of fish and invertebrates as well as important submerged vegetation. Their potential for reproduction is excessive - large females being reported to lay as many as a million eggs.

**Pathway:** Carp, like most other fish in production systems, are known to escape from aquaculture, especially as larvae or young fish. They are then able to disperse in natural systems - both upstream and downstream.

**Management/Control:** Control of feral carp is not feasible in most cases, especially as they are prized by anglers as well as those seeking fish protein. Commercial fishing may reduce densities but not result in control. It is thus important to prevent their further spread.

**Classification:** TELEOSTEI: CYPRINIDAE

**Note:** Aquaculture that produces fish (and other) protein for human consumption (and so poverty alleviation) in Africa is very necessary to augment declining wild fisheries. But it can use both native and safe species to safeguard wetland biodiversity - in preference to alien, potentially invasive species.

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**The Nairobi Declaration. Conservation of aquatic biodiversity and use of genetically improved and alien species for aquaculture in Africa.** This declaration arose from a 4-day discussion (conducted by a consortium of organisations led by ICLARM) about the wisdom, or otherwise, of using alien species (whether originally native or not) for fish production under aquaculture in Africa. It describes the benefits and risks of such introductions, gives ideas on conditions to be considered before introducing new strains or genetically modified fish and states that the liability for adverse environmental impacts of introductions to aquaculture should be borne by those who benefit from such introductions - including restoration of affected systems.
POTENTIAL INVASIVES

Several species of other well-known wetland invasives have already been introduced to Africa but have not yet escaped or become invasive: two of the most serious are described below.

**MYRIOPHYLLUM AQUATICUM**  
*Dicotyledonae: Haloragaceae*

**Common Name:** Water milfoil, Parrot’s feather

**Description:** A perennial, aquatic herb with roots in the substrate and stems, with feathery leaves, emergent or floating on the water surface. The leaves and stems are pale-green to greyish in colour and the plant can have many branches emerging from a lateral, central stolon - sometimes as long as a metre or two.

**Habitat:** *M. aquaticum* is found in shallow waters, up to 2m deep, rooted in mud or stony substrate and preferring water with added nitrogen. It is found in dams, ponds and other artificial wetlands in Africa and will tolerate brackish and polluted waters. It is often grown as an ornamental.

**Origin:** South America (Brazil, Peru, Uruguay, Chile, Argentina); now widely-distributed around the tropics.

**Impacts:** *M. aquaticum* is known to block waterways, dominate other aquatic vegetation and so reduce the diversity of wetlands and their biota. It provides breeding grounds for the vectors of both bilharzia and malaria.

**Pathway:** The seeds spread by water and wind; plant fragments are also capable of vegetative growth. As a horticultural plant and one attractive to gardeners, this plant is most often moved by people - either when purposefully introducing it to new areas or when removing it from horticulture. NB: It is currently present in many horticultural situations in African cities and is beginning to spread into urban wetlands.

**Management/Control:** Physical clearance is quite effective although the plant grows very fast and can reproduce from fragments; chemical control is also possible, and biocontrol shows promise with a leaf-eating beetle (*Lysathia* sp).

**PONTEDERIA CORDATA**  
*Dicotyledonae: Pontederiaceae*

**Common Name:** Pickerel weed, Common Pontederia

**Description:** An emergent, perennial plant with spade-shaped green leaves on long petioles which surround the stem and arise from below water. The plants grow to 2 m in height and have attractive blue flowers (one petal of which has a yellow mark) on a spike.

**Habitat:** *P. cordatum* is grown as an ornamental but can escape to line streams, shallow wetlands and invade irrigation channels and rice paddy.

**Origin:** North, Central and South America.

**Impacts:** Pickerel weed can be an effective competitor for space in wetland situations, act as a serious weed of irrigated fields and can also block waterways.

**Pathway:** *P. cordatum* is easily spread through vegetative means, especially by the movement of its roots / rhizomes after disturbance and efforts to control it! It is not known whether it reproduces sexually in Africa and so spread through fruits and seeds.

**Management/Control:** Only mechanical removal has been used so far, but the disposal of root fragments must be done with care to prevent its escape from horticultural situations to wild wetlands.
WEEDS - not alien invasives

Many species of organisms in Africa can crowd wetlands, cause problems with water movement and wetland biodiversity and have local impacts on peoples’ uses of wetlands - yet they are not alien invasive species. They are often local species that respond to some changing circumstance that makes them more obvious and deleterious to the objectives of wetland management. If they are plants, they are usually called “weeds”; if they are animals they are often called “pests”. Two examples of problem native wetland plants follow; in both cases they are also useful wetland species that provide goods and services to people and biodiversity while also causing problems when they occupy new areas or increase their densities from what was considered “normal”.

VOSSIA CUSPIDATA - Monocotyledonae; Poaceae

Common Name: Hippo grass, Vossia

Description: Vossia is a perennial grass which grows rooted in the edges of streams, lakes and dams and has floating stems that reach sometimes as far as 10m or even 20m onto open water. Vossia is also a dominant grass on many African floodplains which grows with rising waters, spreads along the water surface and then subsides with a receding flood to leave large areas covered with grass. It can also form floating mats and “grass islands” and is capable of growing over other floating aquatic plants (such as Water Hyacinth) to form dense, floating associations of wetland plants.

Habitat: Vossia is found along rivers and creeks in slow-flowing waters and on the edges of lakes, reservoirs and dams. It is found widely on Africa’s floodplains mixed with other aquatic grasses, herbs and reeds.

Origin: A native species widespread in Africa and S-E Asia- sometimes cultivated and usually managed for maximum yield of preferred grazing for livestock.

Impacts: Vossia is an important pasture grass for both livestock and the larger wild herbivores of Africa and provides nutrition for grazers long after the wet seasons and flood times are past. It becomes a problem when grazing is reduced and when disturbance of water systems allows it to grow out from the water’s edge and so block or alter water flow, impede transport and dominate other wetland plants and their attendant biodiversity.

Vossia can also grow on top of invasive species such as Water Hyacinth and Salvinia and so form impenetrable mats which become much more difficult to control than any of the original invaders and can often develop a “sudd” or permanent wetland vegetation complex where none occurred before.

Pathway: Vossia is spread through both seeds and vegetative segments - by water, wild animals, wetland birds, livestock and (mostly unintentionally) by man.

Management/Control: Mechanical clearance of blockages and use of grazing animals can reduce heavy growths. Herbicides commonly used to control grasses can be used - but with care as this grass is valuable fodder for wild and domestic stock.

Note: Management of this grass can become problematic unless all potential users of a wetland agree on the objectives as it is a menace to some and an essential source of survival for others.

Vossia spreading out from a river bank
**TYPHA CAPENSIS and T. DOMINGENSI S** - **Monocot.; Typhaceae**

**Common Name:** Bulrush, Reed mace, Cattail

**Description:** A tall emergent reed (up to 5 m above water level) with long, thin flat leaves and a characteristic flower spike on a stout, tubular stem. This has many, tightly-packed, brown female flowers and cream male flowers above.

**Habitat:** Freshwater wetlands of all types, river and lake edges and shallow dams and ponds as well as irrigation canals and roadside ditches. Typha can grow in slightly saline or sodic waters and is able to colonise temporary and new wetland situations.

**Origin:** Two species of Typha, *T. capensis* and *T. domingensis* are widespread in Africa and the tropics elsewhere; another species (*T. latifolia*) also is distributed naturally from the northern temperate zone to central Africa, while *T. elephantina* is found in parts of West Africa. The bulrushes are thus native to Africa and not alien invasives - although they can become significant “weeds” when they spread.

**Impacts:** Typha species have a wide tolerance of water conditions and are able to colonise new wetland areas and altered water bodies - especially where there is increasing salinity, increasing nutrients in the water or altered water flows. In this way Typha can dominate and replace other wetland vegetation, cause shading of previously open water and prevent peoples’ access to open water and fisheries. It can also increase evapotranspiration (and so cause water loss from water storages) and can block irrigation and drainage canals and water supply systems.

Typha is, however, a valuable wetland plant in Africa with many uses that include fibre for weaving and craft production, roofing, building and fencing materials, fuel and fodder for both domestic and wild animals.

**Pathways:** Bulrushes produce many millions of seeds which have silky strands attached that combine to form a mass of fluffy material that is easily borne by the wind as well as being carried by birds and other animals. In this way Typha can disperse widely and is able to colonise any available wet area - even if it is newly-formed. Thus it can colonise new wetlands (e.g. roadside excavations, barrow pits, abandoned quarries, farm dams, irrigation canals and leakages from water pipelines) quickly and out-compete other native wetland vegetation as a coloniser.

**Management/Control:** In managed water bodies, Typha can be controlled by increasing water depth (beyond 2 m). In wild wetlands, cutting stems under water can control Typha and chemicals (e.g. 2,4-D) have been used - but their management is difficult and being native to Africa, biocontrol is unlikely. As there are many uses for Typha in Africa, its removal may not always be compatible with agreed wetland management objectives.
MANAGING ALIEN INVASIVES IN AFRICA’S WETLANDS

Steps to control invasive species in wetlands with the intent to restore the affected ecosystem (as far as possible) to its former functions and products, and its former status in relation to biodiversity. These suggestions take the “ecosystem approach” as promoted by Ramsar, CBD and many organizations.

A first step is to be aware of the existence and threats of alien invasive species in aquatic ecosystems in Africa.

Second is to recognize an invading species from an “innocent” local species that may be expanding its range or may be in a phase of high density.

Third is to assess the size of the problem in terms of area (or volume) affected and the likely impacts of a developing invasion. At any stage, prevention is better than cure, so if it is possible to prevent the invader from establishing or from spreading, control will be easier.

Next is the need to decide amongst stakeholders of the affected ecosystem what general course of action to take. This will require weighing up costs, benefits, side effects of control, results of no action, traditions, changing needs and political and policy matters.

Then there is need to take technical advice on the best method(s) of control – if the decision to control has been made. Standard methods include mechanical, chemical, biological and integrated control and all have their advantages (and disadvantages) under certain circumstances.

Monitoring should begin as early as possible – to chart the course of the infestation and then to observe the effects of control measures – and finally to ensure that there is no resurgence of the invader.

Management objectives for the control should be agreed upon so that the interests of all stakeholders are considered and the restoration of both human needs and biodiversity are considered.

Ideally, an account of the process, its successes or otherwise, should be published for the record and to help others who may be faced with the same, or similar, problems.

Sources of advice

National governments in Africa have Agricultural, Fisheries, Water Management and (sometimes) Wetland Management agencies that should be consulted. Quarantine facilities have information on alien species and should be alerted to those that can impact wetlands. Some countries have set up inter-sectoral bodies to manage invasive species and/or to oversee the importation of desirable species – including those for biocontrol.

Regional bodies (such as AMCEN, SADC, SILS, IGAD) are developing strategies for alien invasives and international agencies such as FAO and the biodiversity-related conventions (Ramsar, CITES, CBD, CMS) are gradually raising the profile of invasives and the procedures for their control.

The Global Invasive Species Programme is a partnership of several organizations concerned with biological invasions and has produced a 50-page Global Strategy on Invasive Alien Species which outlines the processes to be considered (see next page).

For advice on the recognition and potential threats, as well as possible control measures for invasive species (including those in aquatic systems) the IUCN Invasive Species Specialist Group provides a service through its Global Invasive Species database which is available at www.issg.org/database. There are several other databases of both aquatic and terrestrial invasives – some of which are listed in the GISP Toolkit (see Wittenberg and Cock, 2000, in the reference list).
ANNOTATED SOURCES OF REFERENCE

A selection of reference materials that can give some assistance in following up on wetland invasives in Africa, their recognition and management. A brief idea of the content is appended in italics. Note that there is no text (yet) that covers this topic in any detail across the continent and referring specifically to wetlands.


Julien, M.H., Griffiths, M.W. and Wright, A.D. 1999. Biological control of water hyacinth. The weevils Neochetina bruchi and N. eichhorniae: biologies, host ranges, and rearing, releasing and monitoring techniques for biological control of Eichhornia crassipes. ACIAR, Canberra, Australia, 87pp. Comprehensive technical information on biocontrol of water hyacinth with references to other aspects of this invasive


