

**The UVIMA Project**

*Uchambuzi wa Viumbe kwa Maendeleo*

**Taxonomy for Development in East Africa**

UVIMA Baseline Review Consultancy: **INVASIVE AND ALIEN SPECIES (IAS) IN KENYA**

*Report*

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**Table of content**

Executive summary .....	5
Key consultancy achievements .....	5
1.0 INTRODUCTION.....	6
1.1 Terms of Reference .....	6
2.0 METHODOLOGY.....	7
3.0 EXPERTS AND EXPERTISE ON IAS.....	7
3.1 Expertise the institution has on IAS.....	8
3.2 Collection status .....	8
3.3 Long-term preservation of biological collections .....	9
4.0 MEASURES FOR CONTROLLING IAS .....	9
4.1 Databases .....	10
4.2 Future plans for improving database.....	11
4.3 Future prospects for growth and use for Collection and Database.....	11
4.4 Identify the gaps in handling IAS issues and provide recommendations.....	11
4.5 Communication strategies .....	12
5.0 PARTNERS/COLLABORATORS IN IAS ACTIVITIES/PROJECT.....	12
5.1 Projects/programmes.....	13
5.2 Potential sources of funds .....	14
5.3 Potential partners/collaborators on the project.....	15
6.0 PUBLICATIONS ON IAS IN INSTITUTIONS’ LIBRARY .....	15
7.0 INSTITUTIONS AND MANDATES .....	17
8.0 CHALLENGES AND CONSTRAINTS IN HANDLING IAS .....	18
9.0 CONCLUSION.....	19
9.1 Recommendations on capacity needs at national level.....	19
10.0 References.....	20
Annex I Existing Resources.....	21

*UVIMA- The BioNET-EAFRINET Project, Country Consultancy Report*

Annex II	Status of infrastructure for developing the resources .....	24
Annex III	Current status and future plans of 2, 3 and 4 above .....	29
Annex IV	Existing communication strategies and dissemination channels.....	31
Annex V	Defining specific challenges, constraints, key gaps and opportunities for UVIMA .....	32
Annex VI	Checklist of persons in the country with knowledge in Taxonomy on IAS .....	34
Annex VII	Related Projects.....	37
ANNEX VII	Preliminary Checklist of IAS In Kenya.....	38
Annex X	List of People contacted .....	48

## ABBREVIATIONS

BRAHMS	Botanical Research and Herbarium Management System
CABI	Commonwealth Agricultural Bureaux
CD	Compact Disk
DNA	Deoxyribonucleic Acid
DRSRS	Department for Remote Sensing and Resource Survey
FAO	Food and Agriculture Organization
GIS	Geographic Information System
GloBallast	Global Ballast
IAS	Invasive Alien Species
ICIPE	International Center for Insect Physiology and ecology
ICRAF	International Center for Research in Agro-Forestry
ILRI	International Livestock Research Institute
IUCN	International Union for Conservation of Nature
KARI	Kenya Agriculture Research Institute
KEFRI	Kenya Forestry Research Institute
KEPHIS	Kenya plant Health Inspectorate Service
KFS	Kenya Forest Service
KMFRI	Kenya Marine and Fishery Research Institute
KWS	Kenya Wildlife Service
NARL	National Agricultural Research Laboratories
NEMA	National Environment Management Authority
NGO	Non-Governmental Organization
NMK	National Museums of Kenya
PRA	Participatory Rural Appraisal
SEPASAL	Survey of Economic Plants for Arid and Semi-Arid Lands
TOR	Terms of Reference
UNEP	United Nation Environment Programme
USAID	United State Agency for International Development
UVIMA	Uchambuzi wa Viumbe kwa Maendeleo

## **Executive summary**

The main aim of the consultancy was to document existing capacity and infrastructure for handling IAS issues in Kenya. This involved documentation of institutions, experts, project, programmes and databases involved in curation, management and use of IAS in the country. The consultancy had a task of documenting expertise and capacity needs in IAS area and to make recommendations on how to bridge the gaps by UVIMA project.

In the process of documenting the above information, the consultancy reviewed literature in both online and printed sources. A Questionnaire was administered by sending to respondents by email and physical delivery. This was structured to capture the Terms of Reference and other issues related to IAS. Follow-up was made after one to two weeks. Few respondents were engaged in one-to-one focused discussion on issues that questionnaire did not articulate well.

Over 20 institutions were surveyed for this consultancy. These have potential capacity in handling IAS in various aspects to some extent and with limitation. Among these, only the National Museums of Kenya (NMK) was recognized for their involvement and well established collection and curation of biological specimens. The institution, also, has collections from diverse taxonomic groups and related expertise. DRSRS generate distribution maps of IAS (plants) in the country. The Kenya Wildlife Service has responsibility to handle IAS in protected areas; the National Environment Management Authority (NEMA), is responsible for cross-cutting environmental issues and therefore, has potential capacity to manage IAS in natural systems, and; the Kenya Forest Service (KFS) is concerned with management of forest issues in the country. These institutions vary in the strength of biodiversity collections, mapping, database and management; A few experts with limited expertise in IAS were identified. However, the existing expertise and institutional strengths mentioned above form basis on which different activities/projects on IAS can be developed and improvement/ more involvement with IAS issues derived.

Resources and capacity for handling IAS in various institutions is wanting and therefore, there is need to improve on existing infrastructure for biological acquisitions, collections/curation, database and management in order to comprehensively cover IAS issues. To solve identification problems associated with most IAS in invaded areas, new techniques for species identification such as DNA barcoding should be used to complement traditional taxonomy. Other training on field sampling of specimens and taxonomic identification skills, curation, database and management should be offered to improve engagement of various institutions.

## **Key consultancy achievements**

This study documented institutions, biological collections, databases and expertise in IAS work in the country. Observations were made on the need for training in relevant information application and management skills. Further, the need for complementary resources including repositories at the institutions charged with the responsibility for acquiring and managing reference collections of IAS and related information and versatile data sharing arrangements is emphasized.

## 1.0 INTRODUCTION

Invasive Alien Species (IAS), alternatively called Non-Indigenous Invasive Species are species that occur in areas outside their biogeographical system (Givens, 1994), either deliberately or unintentionally introduced. Reasons for introduction of species in new regions include economic production; horticultural and medicinal value or for research (Givens 1994; De Luca, 1999; Lyons & Miller, 1999). IAS can seriously affect the integrity of ecosystem by changing community structures, ecosystem function through extinction or reduction of native species, and altering ecosystem services hence productivity. They may threaten native species as direct predators or competitors, as vectors of disease, or by modifying the habitat or altering native species dynamics. In the last decade, IAS issues have been contentious globally due to their profound effects on agriculture, livestock and fisheries production; and also their adverse effects on human and ecosystem health. Biodiversity conservationists are currently pre-occupied with loss of native species and biological resources, and habitats because ecologically compromised habitats are easily colonized by IAS, which are less preferred.

IAS thrive due to superior competitive characteristics over the native species; these include fast growth, wide dispersal ranges of propagules, ability to reproduce prolifically and ability to tolerate a wide range of environmental conditions. Most alien species have been revealed to become invaders e.g. pests (Lyons & Miller 1999). Serious IAS infestations normally disrupt entire ecosystems, affecting livelihoods of local people (UNEP, 2000). In Kenya, for example, the water hyacinth –*Eichornia crassipes* (C. Martius) Solm-Laub (Pontederiaceae) affected fishery catches negatively, fresh-water bodies in eastern Africa and some 30 other countries (McNeely, 1997). The introduction of the fishes, Nile perch and *Oreochromis esculentus* in Lake Victoria caused great change on fishery diversity in terms of species composition and biomass. In Lake Naivasha, the introduced Cray fish *Procambrus clarkii* posed competition for the lake vegetation and extra preying by the species. Management of IAS is imperative to conservation of biodiversity and sustenance of economic development. However, Kenya does not have sufficient capacity to assess, monitor and manage IAS issues. Even the existing capacity, mainly spurred by individual interest or academic research, is not well documented. The main aim of the consultancy is to document existing capacities in taxonomic, curation, databases, and management of IAS in the country. This baseline survey was guided by the following TORs.

### 1.1 Terms of Reference

- i) Prepare the tools/methodologies for the review and discuss them with Project Team.
- ii) Document institutions, projects, experts, initiatives, programmes and databases involved in curation, management and use of IAS at national level in Kenya; indicate the current status of the collections, their digitization and associated databases and determine future prospects for growth and use.
- iii) Document the expertise available and make recommendations on capacity needs at national level.
- iv) Identify potential partners, collaborations and linkages regionally and internationally relevant to the UVIMA project working on **IAS**.
- v) Identify the gaps in handling **IAS** issues and provide recommendations as to how the UVIMA project can contribute to bridging the gaps.
- vi) Document current institutional mandates and sources of funding available, additional opportunities and potential for new funding and strategic partnerships to enhance effective delivery of the broader goals and objectives of the UVIMA project.
- vii) Document and address any other pertinent issues not outlined above, in the broader context of and relevant to the UVIMA project concerning baseline review for **IAS** at national level.

## 2.0 METHODOLOGY

Information on IAS was acquired through **literature review** of previous reports and publications. **Internet searches** and downloads were undertaken to complement literature reviews. Also a detailed **Questionnaire** was structured on the TORs/deliverables of the consultancy and circulated to experts working on IAS or contacts at institutions with the mandate of managing these species. The questionnaire included both open and close-ended questions. First, the questionnaire was tested on 6 respondents to test its effectiveness. The final questionnaire was sent to the respondents and follow up made at appointed intervals. **Focused discussion** was undertaken on certain aspects of the ToRS not covered by the questionnaire.

## 3.0 EXPERTS AND EXPERTISE ON IAS

There are few experts and expertise in IAS in the country. However, some of the respondents identified have worked generally on biodiversity research/monitoring, conservation, awareness and education. Below is a table containing names of the experts, expertise, group of species and contacts.

Name	Expertise	Group of species	Institution	Contact
Agnes Lusweti botany	Plants	Plants	National Museums of Kenya	
Arne Witt			CABI	
Geoffrey Howard			IUCN	
Philista Malaki	Ornithology-taxonomy	Birds	NMK	
Ahmed Abdi	Botany	plants	NMK	
Samuel Andanje	Park ecology	Plants and animals	KWS	
Etson Mutitu	Forest pathologist			
Dr. Mordecai Ogada	Ecology	Cray fish	Africa Wildlife Foundation	
Henry Roimen	taxonomy	Plant	DRSRS	
Charles Situma	mapping	Plant	DRSRS	
Dan Kithinji	mapping	Plant	DRSRS	
Frank Msafiri	taxonomy	Plant	DRSRS	
Laban Ojiambo	taxonomy	Plant	DRSRS	
Patrick O. Gang	Wetlands		DRSRS	
Dr. P Wako Wargute	Ecology/Remote Sensing	Plant community	DRSRS	
Joseph Chirchir;	Taxonomist and ethnobotanist		NMK	
Patrick Maundu	Taxonomists and ethnobotanists)		NMK	
Victor Wasonga	Herpetologist	Herpetofauna	NMK	
Bernard Agwanda	mammalogy	mammals	NMK	

### 3.1 Expertise the institution has on IAS

Expertise	Institutions
Taxonomy	NMK, CABI, KARI/NARL
Ecology,	KMFRI, KEFRI, CABI, ICIPE, KWS, NMK, KARI
Quarantine and disposal	CABI, NMK, KEPHIS
Mapping	DRSRS
Population genetics	??
Management	KWS, NEMA
control	KEPHIS, KARI
policy	KARI, KWS, NEMA
legislation	NEMA, KEPHIS, KWS
trade	CABI
Bio-safety	Greenbelt

### 3.2 Collection status

Biological collections are plants and animal specimens. Most of the specimens are acquired directly through field expeditions, sample collections during targeted and general research. Normally, there are varying equipments required for the acquisition exercise. For plants, the plant press is essential for making collections; while, animals various trapping methods and equipments are used for different species. Other means of acquisition include donations by researchers and loaning or exchange by research and partner institutions. Most of collections are stored as dead specimens; others are kept as live especially botanic garden plants. Materials employed in identification of species are literature, taxonomic keys, reference collections, guide books, and Google images. Taxonomic experts are usually handy in distinguishing species. Biological specimens are also currently documented by digitization and generation of photo-plates for back-up references, although few institutions have the capacity to apply this technique. Storage facilities used for keeping biological specimens in collection rooms are cabinets, jars, shelves and freezer. The choice of facility depends on the nature of the biological specimen. Update for collection of specimens is undertaken at intervals or for some continuously by the institutions.

The National Museums of Kenya, with the mandate of research, collection and curation of biological specimens, is the leading institution with comprehensive coverage of various higher taxa groups with over 3.0 million specimens covering mostly indigenous species in the country, but with IAS where they are encountered for the first time. Other institutions do not have well established biological collections; the ones that exist are developed haphazardly and curation skills are lacking among the technical staff in charge of the collections. Apparently, lower organisms (including fungi) are not given any attention for collection or documentation by most of the institutions.

Standard collection acquisition procedures are followed by most institutions and are described as follows; Before specimens are deposited in repositories, they are cured to avoid damage to the specimen and transfer of pests, pathogens. This is done especially by drying or freezing, or chemical application before they are registered in the respective collection rooms. The collections are registered in a special manual registry and given an accession number as is standard procedures. Accompanying information include species name, date

of collection, location of collection, collectors, description of habitat. Later, the information is transferred to computer database (i.e. electronic registry), where they are entered in MS Access/Excel or using other database software. The collections of IAS are stored according to their taxonomic affinities with families of flora or fauna in the repository collections. For examples, for IAS in the herbarium, the specimens are stored at the end of the taxon family under “Cultivated” category.

Basically the collections are used as reference materials by researchers, ecosystem managers, students, farmers, and universities, police and forensic experts.

### 3.3 Long-term preservation of biological collections

Collection types	Preservation/curation methods								
		e.g. Stuffing /skinning	e.g. Formalin, Alcohol	e.g. Refrigeration	e.g. Gel	e.g. Drying, Mounting	Cultivation, quarantine	Slide mounting	Culture
Plant specimens	Institutions					NMK	NMK		
Invertebrates			NMK	NMK		NMK, ICIPE, KEMRI			
Mammals		NMK	NMK						
Fish			NMK, KEMRI			NMK			
Birds		NMK							
Reptiles/Amphibians				NMK, ICIPE					
Microorganisms									
Tissues				All					

### 4.0 MEASURES FOR CONTROLLING IAS

Measures for controlling IAS include activities to control dispersal of IAS and their propagules in and outside the country. The Kenya Plant Health Inspectorate (KEPHIS) is the institution with mandate to screen biological importations (crops). KEPHIS has check points at all entry points for goods shipped into the

country; where invasive alien pests/species are screened. On the other hand the, National Environment Management Authority has the mandate conferred to it by the environment management framework known as Environment Management and Coordinating Acts 1999. Through this, NEMA in collaboration with other institutions undertakes to manage ecosystems by controlling IAS through cycle of identification, inventory, and disposal where possible.

Usually, integrated management strategies are employed for controlling pests and this applies to IAS as well, in collection rooms, agricultural farms, and wild habitats. These include mechanical/physical, chemical, biological and curation maintenance (in collection rooms).

#### 4.1 Databases

**Institutional databases** on biological collections in the country are few; most institutions do not have databases and majority of existing databases are **developed** and **maintained** in institutional departments. Some of these are based on broader taxa e.g. plants/animals, while others are specific to taxonomic groups such as instance, fishes, reptiles, Amphibians, and mammals. Notably, the National Museums of Kenya is the only institution which has core mandate to collect and document biological specimens. Even so, NMk has no database specific to IAS and data available of is scattered amongst databases located in individual departments/sections. The database is **updated continuously** whenever biological (voucher) specimens are added. Retrieval of information from these databases is done using species a key string(s) depending on the query requirements.

Predominant software used for database development and management is Microsoft Access/Excel. Other softwares phasing out the Microsoft in database management are BRAHMS, File Maker, Specify, geo-database (ArcView) and GeoVis. Existing and potential security back-ups for maintaining the database are external hard-disk, CDs, Backup server and hard copies.

Locally, only two **online databases** were indicated existing with the ICRAF and SEPASAL. These databases cover agro-forestry and arid and SEPASAL, respectively. There is no locally designed/maintained online database on IAS and generally biodiversity of Kenya.

Some of the Global online databases listed were:

- Global Invasive Species Programme,
- Global Invasive Species Information Network (GISIN) - *Home GISIN*,
- Ecological Portal (EcoPort)
- Global Invasive Species Database20 (GISD) developed by the IUCN Invasive Species Specialist Group (<http://www.issg.org/database>)
- Inter American Biodiversity Information Network (IABIN) and the IUCN/ISSG Aliens Listserver.
- Scientific Committee on Problem of the Environment (SCOPE)
- International Council for Science (ICSU)
- Wikipedia
- Convention on Biological Diversity,
- The Nature Conservancy (TNC)
- International plant protection Convention (IPPC)
- United State Department of Agriculture Global Compendium of weeds
- Baltic Sea Alien Species Database online since 1997; <http://www.corpi.ku.lt/nemo/mainnemo.html>

#### 4.2 Future plans for improving databases

Questionnaires administered and focused discussions held with some individuals in institutions revealed the need to improve local databases in terms of where they should be located and information sharing with local and foreign researchers and related policy.

- A Centralized database is envisioned in some institutions as a way forward for availing complete information on thematic biodiversity issues.
- Development of thematic based databases by institutions was expressed as one way of capturing IAS issues in the country. Such a strategy has been established for certain ecosystems in the country e.g. Mount Elgon Database.
- Acquisition of modern technologies would improve efficiency of information management. This include hardware computer with large capacity and performance and database software.
- Along with the above, improvement of capacity (skills) in database management would be required for holistic information management.
- It was expressed in most institutions that, since they have website, the institutions might explore development of online database to promote sharing of information with potential partners locally and internationally.

#### 4.3 Future prospects for growth and use for Collection and Database.

The study of invasions in Kenya remains largely subjective and there are few if any attempts to use biological collections as tools in monitoring IAS problems. This may be attributed to the lack of standard/agreed criteria to specify introduced species that are suspected to be invasive, perhaps because this is more or less an ecological phenomenon. Also, IAS do not present as challenges in science research, but rather as challenges in production sectors like agriculture. Indeed the ecological characteristics of plant invasions are on the extreme opposite end of species rarity, which usually is the focus of conservationists. As such, records of IAS at biological collection repositories indicate presence of the species and also, diligence of the collectors and curators of these collections. Collections are the only tangible proof that these IAS exist in an area. They aid further research on IAS and indicate extent of occurrence of the IAS. However, the following challenges need to addressed, to make biological repositories more relevant in the management of IAS;

- i. The collectors of biological materials should embrace robust field collection practices to cover more taxa than their specific interest groups and deliberately collect IAS.
- ii. Government should encourage research in and develop specialty collections for IAS taxa including taxonomic training, curation of materials and improvement of biological material repositories and facilities.
- iii. Research institutions and experts should embrace the use of modern research tools to rapidly redress the shortcomings in research and information on IAS. Such tools include the use of DNA barcoding in taxonomy, GIS techniques in mapping, digital techniques data sharing among others. Also, enlist the participation of members of the public in simple reporting, recording, monitoring and management of IAS challenges.

#### 4.4 Identify the gaps in handling IAS issues and provide recommendations

Kenya has several policies which she invokes on the management of IAS, depending on the taxon involved, mostly, under the ministry of Agriculture but also extensively under ministries charged with the management of natural resources and the environment. This sectarian approach affects efficiency in overall management of challenges and problems associated with the identification, control, monitoring and management of IAS.

Records of IAS in Kenya are variable in number and species specific. These records need to be harmonized into a single or a series of related documents specifically dedicated to IAS, amenable to additions and widely available to stakeholders, including the general public.

Also literature and resources related to the identification, reporting and management tools of IAS are scanty. This is further compounded by the fact that the criteria for what is declared as IAS for Kenya and in the region is not obvious, and decisions are made on *ad hoc* basis leaving wide latitude for accidental introduction of potentially problematic species into the country.

Whereas different ministries and affiliated research institutions cover various aspects of IAS, their actual work programs do not seem to overlap sufficiently to address the IAS problem. These institutions under the guidance of the government planners need to draw up work plans for the overlapping areas in order address such gaps that frequently arise due to interpretation of their mandates, work programs and budget shortfalls. Alongside these, they should work out communication strategies for the collaborative work that they undertake.

Many modern research tools such as DNA barcoding are available, but have not been sufficiently availed for application in the area of IAS due to budgetary constraints.

#### 4.5 Communication strategies

All institutions surveyed have **websites** and office email connection on which **internet** searches and email communication is done. The speed is however moderate in most institutions while others are low and intermittent. Most of the institutions, however, do not post a page specifically on IAS information even though there are initiatives and projects existing on IAS. Among institutions, ICRAF and SEPASAL programme has an online database in which IAS are flagged out. KMFRI houses a national web portal a clearing house mechanism for coastal and marine information. This is however general on all biodiversity and other disciplinary issues and provide meta-data about activities/researches undertaken in the area.

Other than internet, institutions use various strategies for communication on biodiversity issues. Information on IAS is disseminated through technical reports, seminars/workshop, conferences, publications, posters, brochures and farmer field days.

#### 5.0 PARTNERS/COLLABORATORS IN IAS ACTIVITIES/PROJECT

Institutions	Partners/Collaborators
NMK	ICRAF, KWS, CABI, KEFRI, KMFRI, California Academy of Sciences, Alexander Koenig Museum, University of Western Cape
DRSRS	FAO, KEFRI, IUCN, NEMA, KWS Ministry of Agriculture/Water
KARI	
CABI	Uganda Wildlife Authority, Kenya Wildlife Service, Zambia Wildlife Authority
KWS	CABI, NMK,
KMFRI	IUCN, NEMA, KWS, NMK, local universities,
ICIPE	IUCN, ILRI, NEMA, KWS, NMK, local universities,
KEPHIS	NMK, KARI,

## 5.1 Projects/programmes

Project/Programme: Title and duration	Lead Institutions	Geographic Scale (local, national, regional, global)	Target Ecosystems	Target Species	Expected Outputs/ Achievements	End-users
Removing Barriers to Invasive Plant Management in Africa 2005 - 2010	CABI: Arne Witt	Regional – Africa	Biodiversity – forests, savanna, semi-arid regions, water bodies etc.	All in terms of legislation	Legislation, policy, awareness, capacity, localized control etc.	The countries as a whole benefit
African Centre of Phytosanitary Excellence	CABI :	East Africa	Trade	Pests	Increased capacity for PRA etc.	
Inventory and Monitoring of Invasive Waterweed	DRSRS :	National	Wetlands and Water bodies	Invasive water weeds	Reports, Distribution maps	Government Institutions, Riparian communities NGOs, Stake holders
UVIMA		Regional		Plants and animals		
Lake Victoria Environment Management Programme		Regional	Aquatic ecosystems	Invasive water hyacinth, and fishes	Long-term management plan for water weeds in Lake Victoria Basins and Catchments.	Countries in the region (Uganda, Tanzania and Kenya)
Prevention and management of IAS in five continents and in nearly 70 countries	CABI	global	Terrestrial and Aquatic	All species	Trained experts in the regions	All research institutions
Documentation of Alien Invasive species using herbarium specimens:	NMK	National/Local	Terrestrial and Aquatic	Plants	Preliminary list of Invasive Alien plants	Researchers

Documenting impacts of <i>Prosopis juliflora</i> on livelihoods	ICRAF	Local	Terrestrial	Prosopis spp.	Report on management strategies on prosopis	Farmers, policy makers, researchers, local communities.
Global Invasive Species Programme	CABI and others	Global	Terrestrial and Aquatic	All species	IAS documentation	Policy makers, researchers, communities.
Biological Baseline Port Survey of Mombasa Port (GloBallast Programme)	KMFR I	Local	Marine	Port area and adjacent marine	Marine species	Comprehensive list of marine species
Invasive and weedy plants of Lembus Forest and surrounding areas.	NMK	Local	Terrestrial	Plants	All plant species	Researchers, conservationists and forest officers

Other activities on IAS in the country include

- Management of IAS including legislation, policy, quarantine, trade, awareness, capacity building, etc. - CABI
- IAS databasing: California Academy of Sciences and NMK
- Biodiversity Monitoring/Databasing; Alexander Koenig Museum and NMK
- Taxonomy - University of Western Cape and NMK

## 5.2 Potential sources of funds

Source of Funds	Description of funding areas
Global Environment Facility	Environment
World Trade Organization	<b>Trade Issues</b>
Food and Agriculture Organization	Agricultural production
World Bank	Natural resources, Agriculture and infrastructure development
Government of Kenya	All areas
USAID	All areas
Friends of Nairobi National Park (FONNAP)	Park conservation projects
American Wildlife Research Foundation	Conservation of fish, wildlife and other natural resources
British Ecological Society	Provides numerous research grants for young ecologists, including expedition grants.
Center for Tropical Forest Science (Smithsonian)	Research grant program

Tropical Research	
Chicago Zoological Society	Provides small grants assistance for conservation and research projects that help support and advance the zoo's mission.
Columbus Zoo Conservation Fund	Serves as a small grants program that field researchers throughout the world can access by submitting applications directly to the Field Conservation Coordinator.
Critical Ecosystem Partnership Fund (CEPF)	support projects on management of protected areas and coordinating biodiversity corridors, training
International Foundation for Science (Sweden)	Supports young developing country scientists who have the potential for becoming the future research leaders and lead scientists in their nations

### 5.3 Potential partners/collaborators on the project

- National Museums of Kenya
- National Agricultural Research Organization
- Environmental Council of Zambia (ECZ)
- Ethiopian Institute of Agricultural Research (EIAR),
- Council for Scientific and Industrial Research (CSIR)
- International Union for Conservation of Nature (IUCN),
- South Africa Institute Aquatic Biology
- Kenya Plant Health Inspectorate
- National Environment Management Authority,
- Kenya Wildlife Service
- Ministry of Forestry and Wildlife
- Ministry of Agriculture/
- Ministry of Water Water
- Kenya Marine Fisheries and Research Institute
- Kenya Agricultural Research Institute
- Kenya Forest Research Institute
- Eastern African network of BioNET-International (EAFRINET)

### 6.0 PUBLICATIONS ON IAS IN INSTITUTIONS' LIBRARY

Author	Year	Title	Institution housed
GOK	1983	<i>Suppression of Noxious weeds Act: CAP 325</i>	Online: <a href="http://www.kenyalawreports.or.ke">http://www.kenyalawreports.or.ke</a>
Cronk, Q and Fuller, J.L.	1995	<i>Plant invaders</i>	NMK
Kidd, H.	(2000).	Water Hyacinth control: An update. In: <i>Pesticide Outlook-, June 2000, USDA</i>	Online
Kedera, C.J	(2003),	Invasive Alien Plants in Kenya: Status	KEPHIS

and Kuria, B.N.		and Management. In: <i>Proceedings of the Workshop on Invasive Alien Species and the IPPC, 22-26, September, 2003, Rome, FAO, xii, 301 pp</i>	
Chagema K. and Ngugi B. K.	2004	Invasive alien species in Kenya: status and management, KEPHIS, Kenya	KEPHIS
Lusweti, A. M.	(2004).	An Ecological study with special emphasis on Invasive Alien Plants in Meru National Park, Kenya	NMK
HDRA	(2005)	<i>The Challenges of Eradicating Prosopis in Kenya: DFID Policy Brief, London</i>	
Esther Mwangi and Brent Swallow	2005	ICRAF publication	ICRAF
Odeny, D.O.	2006	Laboratory experiments on the growth response of <i>Zostera marina</i> L. and <i>Sargassum muticum</i> (Yendo) Fensholt (NIS) to nutrient elevation (N&P) and potential ecological interactions. Faculty of science, University of Plymouth.	University of Plymouth, Universidade do Algarve and NMK
NMK	2007	Invasion of <i>prosopis juliflora</i> and local livelihoods. Case study from the Lake Baringo area of Kenya	ICRAF, NMK
Ogada, M.O.	2007	Effects of the Louisiana red swamp crayfish ( <i>Procambarus clarkia</i> ) invasion on the food and territorial ecology of the African Clawless otter ( <i>Aonyx capensis</i> ) in the Ewaso Ngiro Ecosystem, Kenya. Department of Zoology, Kenyatta University.	Kenyatta University
DRSRS Report.	2003	Inventory and Monitoring of Invasive waterweeds	DRSRS
Lyimo, J.G, Kangalawe, R.Y.M and Liwenga, E.T	(2008)	Status, Impact and Management of Invasive Alien Species Issues. In: <i>Integrating Environmental Sustainability and Development in Africa (ESEA) Conference, 22-23, May 2008, Dar-es-Salaam.</i>	<a href="http://www.ecsea.org/pdfs/Lyimo.pdf">www.ecsea.org/pdfs/Lyimo.pdf</a>
KEPHIS,	(2008)	Public Awareness – Plants and Biofuels. In: <i>Daily Nation, Friday, 28 November, 2008, Nairobi</i>	
Lusweti, A. M.	(2009).	<i>Tracking Alien plant invasions: Can herbarium records show the extent of Invasion,</i> Unpublished report, Nairobi	NMK

## 7.0 INSTITUTIONS AND MANDATES

Several institutions in the country embrace activities on IAS in one way or another. The activities include research and management of IAS populations, and curation of specimens. These institutions include:

Institution	Mandates
National Museums of Kenya	<ul style="list-style-type: none"> <li>• Collection, preservation, study, documentation and present Kenya's past and present cultural and natural heritage.</li> <li>• conservation of the biological diversity of the East African region</li> </ul>
Kenya Wildlife Service	conservation, protection and management of Kenya's diverse flora and fauna
Kenya Plant and Health Inspectorate	<p>Has 13 areas, however most relevant with the project are:</p> <ul style="list-style-type: none"> <li>• Coordinate all matters relating to crop pests and disease control;</li> <li>• Establish service laboratories to monitor the quality and levels of toxic residues in plants as well as their soils and produce;</li> <li>• Undertake inspection, testing, certification, quarantine control, variety testing and description of seeds and planting materials;</li> <li>• Undertake grading and inspection of plants and plant produce at the ports of entry and exit;</li> <li>• Enforce standards for good husbandry and the control of pests and diseases in national irrigation schemes in conjunction with the National Irrigation Board;</li> <li>• Approve all importation and exportation licenses for plants and seed issued by the Ministry responsible for Commerce and Industry before such importation is implemented;</li> </ul>
Kenya Forestry Research Institution	<ul style="list-style-type: none"> <li>• Conduct research in forestry</li> <li>• Disseminate research findings</li> <li>• Co-operate with other research bodies within and outside Kenya carrying out similar research, and</li> <li>• Establish partnership with other organizations and institutions of higher learning in training and on matters of forestry.</li> </ul>
DRSRS	<ul style="list-style-type: none"> <li>• collection, storage, archiving, analysis, updating and dissemination of geo-spatial information on natural resources for informed decision-making for sustainable management with the aim of reducing environmental degradation and alleviating poverty.</li> </ul>
Ministry of Agriculture	<ul style="list-style-type: none"> <li>• Pests and Diseases Control.</li> <li>• Phytosanitary Services</li> </ul>
CABI	<ul style="list-style-type: none"> <li>• Improving people's lives worldwide by providing information and applying expertise to solve problems in agriculture and the environment.</li> <li>•</li> </ul>
Kenya Agricultural Research Institution	<ul style="list-style-type: none"> <li>• Brings together research programmes in food crops, horticultural and industrial crops, livestock and range management, land and water management and socio-economics.</li> <li>• Promotes sound agricultural research, technology generation and dissemination to ensure food security through improved productivity and environmental conservation.</li> </ul>
Ministry of Agriculture	<ul style="list-style-type: none"> <li>• Food security, income generation, employment creation and foreign exchange earnings.</li> </ul>

Kenya Marine and Fishery Research Institution	<ul style="list-style-type: none"> <li>KMFRI is mandated to conduct aquatic research covering all the Kenyan waters and the corresponding riparian areas including Kenya's EEZ in the Indian Ocean waters.</li> </ul>
National Environment Management Authority	Coordination of environmental management issues
East Africa Wildlife Society	Conservation of biodiversity
International Center for Research and Agro-Forestry	Research, monitoring and promotion of agro forestry resource development
Nile Basin Initiative	
International Center for Insect Physiology and Ecology	Research, monitoring and promotion of human health and livelihood
World Conservation Center (IUCN)	
International Livestock Research Institute	
Nature Kenya	Community conservation
Lake Victoria Basin Development Authority	
Ministry of Environment	Protection of environment
University of Nairobi	Academic, and researches
Kenyatta University	Academic, and researches
Moi University	Academic, and researches
Maseno University	Academic, and researches
Egerton University	Academic, and researches

## 8.0 CHALLENGES AND CONSTRAINTS IN HANDLING IAS

- Acquisition of collections for storage is a sole responsibility for collection managers in various institutions that embrace curation of collection. Normally, planned field expeditions are conducted to acquire good species representative, spatial and temporal coverage. Field collection entails taking away individual species samples from field in dead form. In some cases, back-ups are made for the specimens by taking digital images with a good resolution. Acquisition of collections involve ensuring availability of transport facilities, collection equipments, security and imaging equipment for developing back-ups for the collection. In most cases, these are insufficiently available to most institutions and, therefore, collections of specimens are hampered.
- Some IAS are have potential to disperse in environment and therefore poses risk to environment, and human health. Measures for containing risks are not well placed and therefore handling them is feared.
- Challenge of developing *taxonomic skills* in species identification and *curation* of species are key issues to handling IAS in the country. However, there is lack of capacity in taxonomic skills and also in curation and maintenance of collections. As such, some IAS might not be identified properly in time in order to address issues of concern. Improper skills in curation normally cause damage of collections when being processed and while in storage due to poor maintenance.
- Another challenge concerns creation of sufficient storage resources for the biological collection/specimens. First, there is lack of appropriate *storage facility* for keeping the specimens. *Space* for storage facilities in institutions where collections exist is choked up and there is need for expansion in order to cope up routine collections and storage of research voucher specimens. The collection rooms normally require sufficient ventilation for aeration of rooms from chemical inhalants and bad smells.
- Documentation of features related to the specimen/species is necessary for the proper management of collections. Development of *database* suffices *information management* and potentially promotes *information sharing*. Limitations emerge from lack of efficient performing hardwares (computers),

software and experts in Information Technology (database systems) to develop and run the database. Pertinent challenge exists in information sharing with various stakeholders and general public. Main constraint exists in the policies on data sharing set by the institutions. On the other hand, the nature of database and information entered into database might affect accessibility to the information.

- Lack of funds for institutions affect adversely running special programmes on IAS. Normally this is essential in facilitating activities such as collection acquisition, maintenance, setting up databases, capacity building in taxonomy, field collection, curation and database.

## **9.0 CONCLUSION**

- There is little expertise in IAS handling conferred by the general knowledge in taxonomy and ecology. However, basis for involvement in IAS issues is observed in few projects and publications in the region.
- Various institutions in the country handle collection and databasing of different aspects of IAS issues but also with varying limitations. Some stores biological collections while others possess electronic materials.
- Opportunities exist in various aspects of IAS in the country. Apparently, different institutions have basic potential capacities on which various activities on IAS can be initiated. For instance, NMK has strength in collection, taxonomy, ecology; while, KWS in management.
- Application of the taxonomic information in management of IAS is a good logical step, but this has hardly been attempted.

### **9.1 Recommendations on capacity needs at national level**

- There is need to improve expertise in taxonomic identification of IAS in all categories of flora and fauna. This will improve capacity to identify IAS.
- Building capacity in collection management/curation is recommended at all repositories of biological collections including Herbaria and zoological collections to properly maintain collections.
- Strengthen capacity to collect IAS samples for the biological repositories.
- Development of skills in database establishment and management to enhance information management and build a common information base on IAS and invasions.
- Networking among institutions and experts in the area of IAS and application of collection based information.
- Embrace the use of IT tools such as digitization to ease data sharing within the said networks.
- Training in DNA barcoding technique would distinguish morpho-similar IAS and this can aid in administering appropriate control measures

## 10.0 References

- Adair, R. J. (1995). The threat of Environmental weeds to Biodiversity in Australia: A search for solutions. In (Bradstock, R. A. *et al.*, eds). *Conserving Biodiversity: Threats and Solutions*. Pp 184-201. Surrey Beatty and Sons Pty ltd, NSW.
- Blench, R. and Sommer, F. (1999). *Understanding Rangeland Biodiversity*, Overseas Development Institute (ODI), Chameleon Press, London.
- Cronk, Q. C. B. and Fuller, J. L. (1995). *Plant Invaders*, Chapman and Hall, London, 241 pp.
- D'Antonio, C. M. & Vitousek, P.M. (1992). Biological Invasions by exotic plants: The Grass/Fire cycle and Global Change. *Annu. Rev. Ecol. Sys:* **23**: 63-87.
- De Luca, L. (1999). *Illegal Aliens*, South African Gardening (Montgomery, K. ed.): April issue.
- Givens, D.R. (1994). *Principles and Practice of Plant Conservation*, Chapman & Hall, London
- GOK. (1983) *The Suppression of Noxious Weeds Act: CAP 325 of the Laws of Kenya*. 2<sup>nd</sup> Ed. Government Printer, Nairobi, 5 pp.
- Henderson, L. (2001). *Alien Weeds and Invasive Plants*. Agricultural Research Council, Pretoria, 300 pp.
- Ivens, G. W., (1967). *East African Weeds and their Control*. OUP, Nairobi, 244pp.
- Kedera, C. J. & Kuria, B. N. (2003). *Invasive Alien plants in Kenya: Status and management*. In: Proceedings of the IPPC Workshop, 22-26 September 2003, Braunschweig, In press.
- Lusweti, A.M., (2004). *An Ecological study with special emphasis on Invasive Alien Plants, in Meru National Park Kenya*, MSc. Thesis, Addis Ababa University, 119 pp.
- Lyons, E. E and Miller, S. E., (eds.) (1999). *Invasive Species in Eastern Africa: Proceedings of a Workshop held at ICIPE, July 5-6, 1999*, ICIPE Science Press, Nairobi, Kenya.
- Parker, I. M. and Reichard, S. H. (1998). Critical Issues in Invasion Biology for Conservation Science. pp 283-305. In: Fiedler, P. L & Kareiva, P. M. (eds.) *Conservation Biology for the coming Decade*, 2<sup>nd</sup> Ed. Chapman and Hall, London.
- Reynolds, S. C. P. (2002). *A catalogue of Alien plants in Ireland*. Occasional Papers No. 14, National Botanic Gardens, Glasneven. 414 pp.
- Smith, R. D., G. I Aradottir, A. Taylor and C. H Lyal, (2008). Invasive Species Management-what taxonomic support is needed? Global Invasive Species Programme, Nairobi, Kenya
- UNEP. (2000). *Policy Recommendation: Alien Species that Threaten Ecosystems*, UNEP, Nairobi.
- Westoby, M., Walker, B. H. and Noy-Meir, I. (1989). Opportunistic Management for Rangelands not at Equilibrium. *Journal of Range Management* **42**: 266-274.

11.0 ANNEXES

Annex I Existing Resources

CATEGORY	Source	Where it is developed	Where it is maintained	Where it is Disseminated (or not)	Why developed	Target audience	How - approach/method/design/platform
<b>Collections</b>	1. NMK	In departments	Department	Locally and internationally	Taxonomic research references	Students, researchers, public, professional groups, tour guides, police, and general public	Visits, publication, exhibitions, seminars
	2. DRSRS	In department	Department	Locally	References, Monitoring, education and training	Universities, GoK, gov, institutions, researchers	Pamphlets, reports, websites, maps, technical reports
<b>Databases</b>	3. NMK	In departments	Department	Locally	References, education and training	Students, researchers, public, professional groups, tour guides, police, and general public	Visits, publication, exhibitions, seminars
	4.DRSRS	In department	Department	Locally	References, Monitoring education and training	Universities, GoK, gov, institutions, researchers	Pamphlets, reports, websites, maps, technical reports
	5.KARI	In centralized location	In centralized location	Locally	References, Monitoring education and training	Students, farmers, researchers	Farmer field days
	6.KWS	In department and Park Units	In department and Park Units	Locally	Monitoring	Park managers/wardens	Report recommendations
	7.KMFRI	In department	In department	Locally	References and monitoring	Researchers, students, fisheries managers	Visits, publication, exhibitions, seminars

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	8. KEFRI	In department	In department	Locally	References and monitoring	Researchers, students and forest managers	Visits, publication, exhibitions, seminars
<b>Secondary e.g. keys, literature, publications and tertiary</b>	1. NMK	NMK	NMK Library	NMK-Library	For research references, awareness, studies,	NMK staffs and Nature Kenya members	Visits, outreach
	2. DRSRS	In department	In department	Locally	Research, reporting and information awareness	Government institutions, NGOs, researchers,	Visits, seminars/workshop
	3. KARI	In department	In department	Locally	References, Monitoring	Researchers, Farmers public, Students, professional groups	Visits, outreach
	4. KWS	In department and Park Units t	In department and Park Units	Locally	For baseline information, Monitoring, tourist guide	Park managers, wardens Students, researchers, public, professional groups, tour guides, tourists	Visits, website
	5. KMFRI	In department	In department	Locally, website	References, Monitoring education and training	Researchers, public, Students, professional groups	Visits, website
<b>Communication resources</b>	1. NMK	NMK research directorate and departments	NMK research directorate and departments	NMK research directorate, departments and locally	For provision of information on biodiversity and research activities	Students, researchers, policy makers, public, professional groups, tour guides, police, and general public	Visits, conferences/seminars, public lectures, documentaries, open day, workshop, publications
	2. DRSRS	In department	In department	Locally, website	For geo-spatial information dissemination	Researchers, ecosystem managers, Environment Institutions, NGOs,	Visits, seminars, workshop
	3. KARI	Department	In department	Locally, website	Dissemination of researches	Researchers, Farmers public, Students,	

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						professional groups	
	4. KWS	In department and Park Units	In department and Park Units	Locally, website			
<b>Mapping</b>	DRSRS	DRSRS	DRSRS	DRSRS	Mapping distribution, inventory		
<b>Expertise</b>							

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Annex II Status of infrastructure for developing the resources

CATEGORY	Institutions Responsible (List all institutions you have come across in your country, including addresses, telephones and contact person(s))	STATUS Rank from 0-10 where 0 = not available and 10 = in good/excellent condition	PROGRESS Description of work undertaken to improve the resource	ISSUES Description of problems encountered; Issues that need to be addressed; Decisions / Actions that can be taken
Collections	NMK Contact person: HOD Botany, Zoology  P.O. Box 45166, 00100 Nairobi, Kenya	8	Update of collections on various taxa group is undertaken continuously	Inadequate transport, equipment and facilities for field collection of specimens and storages
	DRSRS Contact person:	3	Update of plant collections is undertaken continuously	Lack of resources for field collections and herbarium
Databases	NMK Contact person: HODs Botany, and Zoology  P.O. Box 40658, 00100 Nairobi, Kenya	6	Existing database in Microsoft Excel/Access is faced out with BRAHM and specify	Database management skills is however inadequate compared with data that needs to be transferred from hard copy registry to database
	DRSRS Contact person: Director	8	Update of database is undertaken continuously	Field collection if scanty
	KARI/NARL	6	Update of database is undertaken continuously	Field collection is limited to few areas. They collect single specimens. Long-storage facility is not suitable for herbarium specimens
	KWS	1	- Initiation of database development for IAS is	Limited taxonomic capacity among the park managers

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	Contact person: Dr. Andaje/Lekishon		on-going	
Secondary e.g. keys, literature, publications and tertiary	NMK Contact person: Asha Owano (NMK library) and Monica Agengo (Herbarium Library)  P.O. Box 40658, 00100 Nairobi, Kenya	5	- Electronic catalogues is developed for the NMK library - Continuous acquisition of publications	- Poor cataloguing of herbarium library - Scanty literature
	KARI/NARL	2	Intermittent acquisition of publications	Scanty literature
	KWS Contact person: Dr. Andaje	2	Intermittent acquisition of publications	Scanty literature
	KMFRI	2	- Continuous acquisition of publications - List of publications are listed in their website	
	DRSRS		- Continuous acquisition geo-spatial data	Interpretation of the data requires special skills which are scarce and the information is on large geographical scale.
Communication resources	NMK Contact person: Director Research and Collection	5	- Internet infrastructures installed - Posting of biodiversity issues from department in institution website - Erection for notice boards for posters for information display	- Slow internet speed -
	DRSRS Contact person:	5	-	-

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	KARI/NARL Contact person:	6	Progressive update of new events in their website	In the process of uploading data online but no information on IAS
	KWS Contact person: Dr. Andaje/Lekishon	5	- Highlights topical issues in biodiversity conservation - The have radio-call for quick communication	
	KMFRI Contact person:	6	Recent development of a regional server (portal) online database for meta-data on coastal and marine biodiversity	Occasional failure of server
Other resources				

5. Documentation of new opportunities where they exist

CATEGORY	Name List all new opportunities you have come across in your country)	Institution List the all institutions in your country where this new opportunity is	STATUS Rank from 0-10 where 0 = not available and 10 = in good/excellent condition	Detail Details of the institutions including addresses, telephones and contact person(s)
Technologies	Image digitization	NMK,	5	Dr. Siro Masinde

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				NMK c/o Botany
	PCR	NMK	7	Dr. Kem Githui Molecular Genetics
		ICIPE	9	Bonaventure Omondi Molecular Biology
	Web-portal	KMFRI	6	
		NMK		Lawrence Monda IT Department, NMK
<b>Expertise</b>	Bioinformatics,	NMK	4	Simon Kangethe
		ICIPE	6	Bonaventure Omondi Molecular Biology
	DNA barcoding	NMK	5	NMK, P.O. Box 40658, 00100 NRB, Kenya. +254 20 3742131 Person: Dickens Odeny
		ICIPE	7	Dan Masiga ICIPE, P.O

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	Taxonomic identification	NMK	9	Taxonomists and Technicians  NMK, P.O. Box 40658, 00100 NRB, Kenya. +254 20 3742131
	Curation	NMK	10	Collection Managers/Technicians  NMK, P.O. Box 40658, 00100 NRB, Kenya. +254 20 3742131
	Mapping	DRSRS	9	Dan Kithinji, Charles Situma, Patrick Gang,
		NMK	5	Simon Kangethe, Dickens Odeny, Philista Malaki
<b>Hardware</b>	PCR machine	NMK	5	Kem Githui
		ICIPE	7	Bonaventure Omondi  Molecular Biology
	Computers	All institutions	6	
<b>Software</b>	GIS ArcView/ArcGIS, GeoVIS,	DRSRS	8	Dan Kithinji, Charles Situma, Patrick Gang
	BRAHMS, specify	NMK	3	Nickson Otieno, Jack ..... Simon Kangethe and all

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				Technicians
<b>Programmes</b>	Mapping Invasive water weeds	DRSRS	5	Henry Roimen
	Lake Victoria Environment Programme	KMFRI, Min. of Fishery Development, Min. of Water,		Fishery Department
<b>Projects and partnerships</b>	Removing Barriers to Invasive Plant Management in Africa 2005 - 2010	CABI		Arne Witt
	African Centre of Phytosanitary Excellence (completed)	CABI		Arne Witt
<b>Others</b>				

**Annex III Current status and future plans of 2, 3 and 4 above**

CATEGORY	Current status	Gaps	Future plans
<b>Collections and Databases</b>	- Currently, NMK has a good biological recollections reference comprising of most taxa of IAS. Other institutions such as KARI/NARL, KWS, DRSRS, and Universities have few	-Lower taxa are under-represented in the collections or do not even exist. - IAS collection and databasing is inexhaustive. -IAS list and specific problem species are	Encourage more robust collecting among the researchers, to cover IAS

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	collections.  - Generally, databasing is poor in the country.	variable.	
<b>Secondary e.g. keys, literature, publications and tertiary</b>	Secondary information are scanty and most of materials occur in offices not library	Need for published data and reports of IAS and their accessibility to users are wanting.	Define acceptable criteria to be applied across board.
<b>Communication resources</b>	Different institutions charged with management and researches have websites and physical mailing systems and networks.	Most of these institutions have not exhausted their capacity to disseminate IAS information through the websites and most have not explored online databases and do not have URL linkages.	Some institutions such as KARI, KMFRI have started sharing data online.  NMK is planning to increase the broad band size and there are possibilities for data sharing.
<b>Technologies</b>	Most institutions have invested in modern information technologies. A few have also embraced genetic typing, imaging and digitization	Some of the new technologies in genetic studies have not been fully explored.	Improve conditions of the laboratories in genetic typing, imaging and digitization in various institutions.  NMK has future plan to provide intra-portals in the institution
<b>Expertise</b>	There are few dedicated taxonomists and researchers in the area of IAS.  Molecular DNA expertise for identification of IAS is also limited.	There is little focus on the systematics of IAS, and their general management.	Increase expertise in taxonomy and general studies of IAS and expertise in morphospecies analysis.
<b>Hardware</b>	All institutions has computers	Limited storage capacity of computer	Acquiring more computers with higher storage capacity
<b>Software</b>	Microsoft is common among the	Acquisition of and	Purchase of new softwares and training

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	institution computers	adaptation to new softwares for IAS data management e.g. specify, BRAHMS, Geodatabase softwares is slow	of personnel in application of the related softwares
<b>Programmes</b>	Five programmes are on-going; among them, three are regional and one is international programme	Collaboration	Incorporation of the programmes with
<b>Projects and partnerships</b>	Two projects are recorded	Collaboration, funding	

**Annex IV Existing communication strategies and dissemination channels**

<b>STRATEGIES AND CHANNELS</b>	<b>Name</b>	<b>Institution</b> List the all institutions in your country where these are located	<b>CONTACTS</b> Give contact details of the Institution and focal person
Networks	EAFRINET	NMK, KEFRI, KMFRI, UoN, KARI, Moi University, Kenyatta University, Jomo Kenyatta University of Agriculture and Technology, NEMA, e.t.c.	Dr. Wanja Kinuthia - NMK
	WIOMSA	KMFRI, KWS, NEMA, UoN, NMK, CORDIO, WWF, IUCN	Jackline Uku - KMFRI
	IUCN/ISSG Aliens List server.	IUCN, NMK,	Dr. Geoffrey Howard
Forums	Kenya Wetland Forum	EAWLS, NMK, KWS, NEMA, KU, UoN	Ms. Catherine Yaa -EAWLS

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	Invasive Species Specialist Group	IUCN, NMK, KWS, ....	
Partnerships/Collaborations	Programme: Removing Barriers to Invasive Plant Management in Africa 2005 - 2010	National Agricultural Research Organisation , Environmental Council of Zambia, Ethiopian Institute of Agricultural Research, Council for Scientific and Industrial Research  <b>, International Union for Conservation of Nature, Kenya Plant Health Inspectorate Service (KEPHIS)</b>	Mr. Arne Witt
	GloBallast Programme	GloBallast Programme SA, KPA, NMK, Kenya Navy, GISP	

**Annex V Defining specific challenges, constraints, key gaps and opportunities for UVIMA**

#	Issue/Category	Specific challenges	Constraints	Key gaps	Opportunities	Proposed Solution
1	Specimen collection and curation	<ul style="list-style-type: none"> <li>- Collection of specimens</li> <li>- Acquisition of materials</li> <li>- Transport</li> <li>- Field accessibility, security</li> <li>- Acquisition sampling equipments</li> <li>- Imaging equipment</li> </ul>	<ul style="list-style-type: none"> <li>- Lack of equipments for collection,</li> <li>- Lack of transport</li> <li>- Lack of curation facilities</li> <li>- Insecurity</li> <li>- Remoteness</li> <li>- Inadequate checklists</li> </ul>	IAS are not covered comprehensively in collection	There are existing collections in the country in few institution on which new collection projects can develop from.	Initiate specific project developing collection of IAS Train parataxonomists. Provide easy to use taxonomic tools for public and land stewards.
2.	Storage for collection	<ul style="list-style-type: none"> <li>- Space for storage of collection</li> <li>- Storage facility</li> </ul>	<ul style="list-style-type: none"> <li>- Lack of space and storage facilities for IAS</li> </ul>	Specific storage does not exist for IAS	lack storage facilities can be added in Some storage rooms in order to separate IAS groups from existing collections e.g. in	Establishment of new facilities would create more space for IAS collection. Construction of more collection

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					cabinets, shelves e.t.c.	rooms to accommodate updates Digitize point and observation data.
3.	Skills	<ul style="list-style-type: none"> <li>- Species identification</li> <li>- Curation/preservations and maintenance</li> </ul>	<ul style="list-style-type: none"> <li>- Few interested/dedicated taxonomists</li> <li>- lack of curation skills</li> </ul>	Development of expertise for IAS taxonomy		Expert /Expert training
4.	Information management (database)	<ul style="list-style-type: none"> <li>- Expertise</li> <li>- Software</li> <li>- Hardware</li> <li>- Data sharing</li> </ul>	<ul style="list-style-type: none"> <li>- Lack of expertise in database</li> <li>- Poor systems of sharing information</li> <li>- Poor existing hardware for database</li> </ul>	<ul style="list-style-type: none"> <li>- Communication tools and strategies are not in place</li> <li>- Online sharing of data is very limited</li> <li>- Information dissemination</li> <li>-</li> </ul>	<ul style="list-style-type: none"> <li>- Institutions have websites on which online database can be developed</li> <li>- institution have some information on which data interoperability can be initiated</li> </ul>	<ul style="list-style-type: none"> <li>- Training on database development and management for the institutions</li> <li>- Creation of national portal for online database</li> <li>- Avail IAS reports and data online.</li> <li>- Upgrading of the existing hardware and software at participating institutions.</li> </ul>
5.	Security	<ul style="list-style-type: none"> <li>- Theft</li> <li>- Piracy</li> <li>- Fire</li> <li>-</li> </ul>	<ul style="list-style-type: none"> <li>- Lack of security</li> <li>- Poor policy on data management</li> <li>- Lack of fire extinguishers</li> <li>-</li> </ul>	Bio-security (threats due natural propagules dispersal.	Training stakeholders on existing and looming biosecurity concerns likely to originate from IAS spread.	Encourage public participation in reporting IAS. Start IAS management programs.
6.	Pests:	<ul style="list-style-type: none"> <li>- Infestation of collections</li> <li>- Damage to specimen storage facility</li> <li>- Risk to human health</li> </ul>	- Inadequate pest control measures	<ul style="list-style-type: none"> <li>- Integrated Pest Management strategies</li> <li>- Inappropriate storage facilities</li> </ul>	- Establishment of quarantine facilities	Practice Integrated Pest Management

Annex VI Checklist of persons in the country with knowledge in Taxonomy on IAS

Name	Qualification	Courier Address	Phone-Desk	Phone-Mobile	Email1	Email2
Geoffrey Mwachala	Ph.D	P.O. Box 40658, 00100, Nairobi, Kenya	+254-20- 3742131 ext. 2274		gmwachala@museums.or.ke	
Agnes Lusweti	MSc.	P.O. Box 40658, 00100, Nairobi, Kenya	+254-20- 3742131 ext. 2286	+254-(0) 721632365	alusweti@museums.or.ke	
Hottensiah W. Mwangi	MSc.	NARL, P.O. Box 14733, Nairobi			Wambuihm@yahoo.com	
Teresia W. Karanja	MSc.	NARL, P.O. Box 14733, Nairobi	+254-20- 4441973		dhcokb@yahoo.com	
Samuel Andanje	Ph.D	Kenya Wildlife Service P.O. Box 40241 - 00100 Nairobi Kenya	Tel: +254 (020) 600800 +254 (020) 602345		sandaje@kws.go.ke	
Arne Witt	MSc.	CABI Africa ICRAF Complex, United Nations Avenue, Gigiri, PO Box 633-00621, Nairobi, Kenya	Tel: +254 20 72 24450		a.witt@cabi.org	
Henry Roimen – Taxonomy	MSc.	DRSRS, P.O. Box 47146, NRB, Kenya			roimen@hotmail.com; hproimen@yahoo.com	
Dan Kithinji	MSc	DRSRS, P.O. Box 47146, NRB, Kenya			dakithinji@yahoo.com	

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Frank Msafiri	MSc.	P.O. Box 47146, NRB, Kenya			<a href="mailto:bfmsafiri@yahoo.com">bfmsafiri@yahoo.com</a>	
Laban Odhiambo	MSc	P.O. Box 47146, NRB, Kenya				
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**Annex VII Related Projects**

Project Name	Implementing institution	Source of funding	Status (project beginning, mid-term, ending)	Focal person	Contact details
Mapping Invasive water weeds	DRSRS	Government of Kenya	Project ended	Dan Marangu	DRSRS, NRB
Documentation of Alien Invasive species using herbarium specimens	NMK				NMK, NRB
Documenting impacts of Prosopis juliflora on livelihoods	NMK		Project ended	Abdi	NMK, NRB
Mapping invasive Alien Plants in Protected Areas	KWS		Long-Term	Mr. Lekishon	KWS, NRB
Removing Barriers to Invasive Plant Management in Africa 2005 - 2010	CABI		Ending		CABI, NRB
African Centre of Phytosanitary Excellence	CABI		On-going		CABI, NRB
Invasive and weedy plants of Lembus Forest and surrounding areas.	NMK		Ended	Geofrey Mwachala	P.O. Box 40658, 00100, NRB, Kenya
Biological Baseline Port Survey of Mombasa Port (GloBallast Programme)	KMFRI		On-going	Esther Fondo	KMFRI

**ANNEX VII Preliminary Checklist of IAS In Kenya**

Sources; Ivens, 1967; GOK, 1983; Henderson, 2001; Mwachala, 2007; Kephis, 2008; Lusweti, 2009

**Plants**

Scientific Name	Common name
<i>Acacia mearnsii</i>	Wattle tree
<i>Acacia melanoxylon</i>	Black wattle
<i>Acanthospermum hispidum</i>	Goat's head
<i>Acanthospermum glabratum</i>	Starburr
<i>Achyranthes aspera</i> L.	Burweed, Chaff flower
<i>Agave americana</i> L.	American agave
<i>Agave sisalana</i> Perrine	Sisal
<i>Ageratum conyzoides</i> L.	Mexican ageratum
<i>Albizia lebbbeck (L.) Benth.</i>	Lebbeck tree
<i>Albizia procera</i> (Roxb.) Benth.	False lebbeck
<i>Albahi maurorum</i> Medik.	Camelthorn bush
<i>Alternanthera pungens</i>	Khaki weed
<i>Amaranthus spp</i>	Amaranth
<i>Amelanchier canadensis</i>	Serviceberry
<i>Anredera cordifolia</i> (Ten.) Steenis	
<i>Antigonon leptopus</i>	
<i>Araujia sericifera</i> Brot.	
<i>Argemone mexicana</i> L.	Mexican poppies
<i>Aristolochia elegans</i> Mast.	Dutchman's pipe, Calico flower
<i>Artocarpus communis, A. altilis</i>	Breadfruit
<i>Arundo donax</i>	Giant reed
<i>Arundo donax</i>	Giant reed
<i>Atriplex nummularia</i> Lindl.	Old man saltbush
<i>Avena sterilis</i>	Animated oat
<i>Avena fatua</i>	Common wild oat
<i>Azadirachta indica</i>	Neem
<i>Azolla pinnata</i>	
<i>Bauhinia purpurea</i> L.	Butterfly orchid
<i>Bauhinia variegata</i> L.	Orchid tree
<i>Brassica napus</i>	Rapeseed/Canola
<i>Bryophyllum delagoense</i> (Eckl & Zeyh.) Schinz.	Chandelier plant
<i>C. suaveolens</i> Ser.	
<i>Caesalpinia decapetala</i> (Roth.) Alston	Mysore, Mauritius thorn
<i>Camelina sativa</i>	False flax
<i>Campuloclinum macrocephalum</i>	
<i>Canna indica</i>	Indian shot, Garden canna
<i>Capsella bursa-pastoris</i> (L.) Med.	
<i>Cardiospermum grandiflorum</i> Sw.	Baloon vine
<i>Cardiospermum halicacabum</i> L.	Heart pea, Lesser balloon vine
<i>Casuarina cunninghamiana</i> Miq.	
<i>Casuarina equisetifolia</i> L.	Whispering pine
<i>Catharanthus roseus</i> (L.) G. Don.	Madagascar periwinkle
<i>Celtis australis</i> L.	Nettle tree, Hackberry tree
<i>Cereus jamacaru</i>	Queen of the night
<i>Cestrum aurantiacum</i> Lindl.	Yellow cestrum

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<i>Cestrum elegans</i> (Brogn.) Schtdl.	Crimson cestrum
<i>Cestrum laevigatum</i> Schtdl.	Inkberry
<i>Cestrum parqui</i> L'Her.	Chilean cestrum
<i>Chromolaena odorata</i> (L.) R.M.King & H.Rob.	Triffid weed
<i>Cinnamomum camphora</i> (L.) Presl.	Camphor tree
<i>Cirsium vulgare</i> (Savi) Ten.	Spear thistle, Scotch thistle
<i>Cocos nucifera</i>	Coconut
	Congress grass
<i>Convolvulus arvensis</i> L.	
<i>Coreopsis lanceolata</i> L.	
<i>Cortaderia jubata</i>	Purple pampas, Pampas grass
<i>Cortaderia selloana</i>	Pampas grass
<i>Cotoneaster pannosus</i> Franch.	Silver leaf cotoneaster
<i>Crataegus</i> spp.	Hawthorn
<i>Cuscuta campestris</i> Yunck.	
<i>Cytisus scoparius</i> (L.) Link	Scotch broom
<i>Datura ferox</i> L.	Large thorn apple
<i>Datura innoxia</i> Mill.	Downy thorn apple
<i>Datura stramonium</i> L.	Common thorn apple
<i>Diospyros kai</i>	Oriental persimon
<i>Diospyros virginiana</i>	Persimon
<i>Duranta erecta</i> L.	Forget-me-not tree, Pigeon berry
<i>Echinopsis spachiana</i> (Lem.) Friedrich & Rowley	Torch cactus
<i>Echium plantagineum</i>	
<i>Eichornia crassipes</i> L.	Water hyacinth
<i>Elaeis guineensis</i>	African oil palm
<i>Eryobotria japonica</i> (Thunb.) Lindl.	Loquat
<i>Eucalyptus</i> spp.	Gum tree
<i>Eugenia uniflora</i> L.	Pittanga or Surinam cherry
<i>Galinsoga parviflora</i>	Potato weed
<i>Gleditsia triacanthos</i> L.	Honey locust
<i>Gleditsia triacanthos</i>	Honeylocust
<i>Grevillea robusta</i> A. Cunn. ex R.Br.	Australian silky oak
<i>Hakea drupacea</i> (C.F. Gaertn.) Roem & Schult.	Sweet hakea
<i>Hakea gibbosa</i> (Sm.) Cav.	Rock hakea
<i>Hakea sericea</i> Schrad. & J.C. Wendl.	Silky hakea
<i>Harrisia martini</i>	
<i>Hedychium coccineum</i> Sm.	Red ginger lily, Kahili ginger lily
<i>Hedychium coronarium</i> J.Konig	White & Yellow ginger lily
<i>Ipomoea</i> spp.	Morning glories
<i>Jacaranda mimosifolia</i> D.Don.	Jacaranda
<i>Jatropha curcas</i>	Physic nut
<i>Lantana camara</i> L.	Lantana
<i>Lavatera arborea</i> L.	Tree mallow
<i>Lepidium draba</i> L.	
<i>Leptospermum laevigatum</i> (Gaertn.) F.Muell.	Australian myrtle
<i>Leucaena leucocephala</i> (Lam.) de Wit	Leucaena
<i>Ligustrum</i> spp	Privets
<i>Lilium formosanum</i> A. Wallace	St. Joseph's lily, Formosa lily
<i>Lolium temulentum</i>	Darnel ryegrass
<i>Lonicera japonica</i>	

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<i>Lythrum salicaria</i> L.	Purple loosestrife
<i>Macfadyena unguis-cati</i> (L.) A. H. Gentry	Cat's claw creeper
<i>Maclura pomifera</i>	Osage orange
<i>Melia azedarach</i> L.	Syringa, Persian lilac
<i>Metrosideros excelsa</i> Sol. ex Gaertn.	New Zealand bottlebrush
<i>Mimosa pigra</i> L.	Giant sensitive plant
<i>Miscanthus X giganteus</i>	Chinese silvergrass
<i>Montanoa hibiscifolia</i> Benth.	Tree daisy
<i>Morus alba</i> L.	Common mulberry
<i>Nephrolepis exaltata</i>	Sword fern
<i>Nerium oleander</i> L.	Oleander
<i>Nicotiana glauca</i> Grabam	Wild tobacco
<i>Oenothera</i> spp.	
<i>Olea europaea</i>	Olive tree
<i>Opuntia aurantiaca</i> Lindl.	Jointed cactus
<i>Opuntia exaltata</i> A. Berger	Longspine cactus
<i>Opuntia ficus-indica</i> (L.) Mill.	Sweet prickly pear
<i>Opuntia fulgida</i> Engelm.	Rosea cactus
<i>Opuntia humifusa</i> (Raf.) Raf.	Creeping prickly pear, Larger flowered pear
<i>Opuntia imbricate</i> (Haw.) D.c.	Imbricate prickly pear
<i>Opuntia lindheimeri</i> Engelm.	Small round-leaved prickly pear
<i>Opuntia spinulifera</i> Salm-Dyck	Saucepan cactus
<i>Opuntia stricta</i> (Haw.) Haw.	Australian pest pear
<i>Orobanche minor</i> Sm.	Clover broomrape, Lesser broomrape
<i>Osteospermum vaillantii</i>	African bush daisy
<i>Panicum virgatum</i>	Switch grass
<i>Parkinsonia aculeata</i> L.	Jerusalem thorn
<i>Parthenium hysterophorus</i> L.	Parthenium,
<i>Passiflora caerulea</i> L.	
<i>Passiflora suberosa</i> L.	
<i>Passiflora subpeltata</i> Ortega	Granadina
<i>Pennisetum purpureum</i>	Elephant grass
<i>Pennisetum setaceum</i>	Napier grass
<i>Pereskia aculeate</i> Mill.	Pereskia, Barbados gooseberry
<i>Phalaris arundinacea</i>	Reed canarygrass
<i>Phormium tenax</i>	New Zealand flax
<i>Phytolacca dioica</i> L.	Belhambra
<i>Pinus elliotii</i> Engelm.	
<i>Pinus patula</i> Schldl. & Cham	Patula pine
<i>Pinus radiata</i> D.Don.	Radiata pine
<i>Pitiosporum undulatum</i> Vent.	Australian cheesewood
<i>Plectranthus comosus</i> Sims	Woolly plectranthus
<i>Populus alba</i> L.	White poplar
<i>Populus</i> spp	Poplar
<i>Prosopis juliflora</i> , spp	Mesquite
<i>Prosopis</i> spp.	Mesquite
<i>Pueraria lobata</i> (Willd.) Ohwi	
<i>Pyrracantha angustifolia</i> (Franch.) C.K. Schneid.	Yellow fire thorn
<i>Quercus acutissima</i>	Sawtooth oak
<i>Rhus succedanea</i> L.	Wax tree
<i>Ricinus communis</i> L.	Castor oil plant

<i>Rivina humilis</i>	
<i>Rosa multiflora</i> Thunb. ex Murray	Multiflora rose
<i>Rosa rubiginosa</i> L.	Sweetbriar, Eglantine
<i>Rubus</i> cv. <i>Fruiticosus</i>	Blackberry
<i>Rubus idaeus</i>	Raspberry
<i>Rubus</i> spp.	Blackberries, Brambles
<i>Salix babylonica</i> L.	Weeping willow
<i>Salvinia molesta</i>	Kariba weed
<i>Sambucus canadensis</i>	Elderberry
<i>Sapium sebiferum</i> / <i>Triadica sebifera</i>	Chinese tallow
<i>Schinus molle</i> L.	Pepper tree
<i>Schkueria pinnata</i>	
<i>Senna bicapsularis</i> (L.) Roxb.	Rambling cassia
<i>Senna pendula</i> (Willd.) Irwin & Barneby	
<i>Senna</i> spp.	
<i>Sesbania punicea</i> (Cav.) Benth.	Red sesbania
<i>Solanum mauritianum</i>	Bugweed
<i>Solanum seaforthianum</i> Andr.	Potato creeper
<i>Solanum sissymbriifolium</i> Lam.	Dense-thorned bitter apple
<i>Sorghum halapense</i>	Johnson grass
<i>Spartium junceum</i> L.	Spanish broom
<i>Spergula arvensis</i> L.	
<i>Stellaria media</i> (L.) Vill.	
<i>Syzygium cumini</i> (L.) Skeels	Jambolan
<i>Syzygium jambos</i> (L.) Alston	Rose apple
<i>Syzygium paniculatum</i> Gaertn.	Australian water pear, brush-cherry
<i>Tagetes minuta</i>	Mexican marigold
<i>Tamarix chinensis</i> Lour.	Chinese tamarisk
<i>Tecoma stans</i>	Yellow bells
<i>Thelectonia trilobata</i> (L.) H.Rob. & Cuatrec.	
<i>Thevetia peruviana</i> (Pers.) K.Schum.	Yellow oleander
<i>Tipuana tipu</i> (Benth.) Kuntze	Tipu tree
<i>Tithonia diversifolia</i> (Hemsl.) A.Gray	Mexican sunflower
<i>Toona ciliata</i> M. Roem.	Toon tree
<i>Tridax procumbens</i>	
<i>Ulex europaeus</i>	European gorse
<i>Vaccinium</i> cf. <i>angustifolium</i>	Blueberry
<i>Verbena brasiliensis</i>	Brazilian vervain
<i>Viburnum trilobum</i>	Highbush cranberry
<i>Xanthium spinosum</i> L.	Spiny cocklebur
<i>Xanthium strumarium</i> L.	Large cocklebur
<i>Ziziphus mauritiana</i>	Chinese apple, Cottony jujube

## Fauna

### Arthropods

Scientific name	Species common name
<i>Prostephanus truncatus</i>	Larger grain borer

<i>Liriomyza trifolii</i> (Burgess)	Serpentine leafminer
<i>Frankliniella occidentalis</i> (Pergande)	Western flower thrips
<i>Cinara cupressivora</i>	Cypress aphid
<i>Diuraphis noxia</i>	Russian aphid
<i>Phenacoccus manihoti</i>	Cassava mealybug
<i>Heteropsylla cubana</i>	Leucaena psyllid
<i>Aleurothrixus floccosus</i>	Citrus woolly whitefly
<i>Calacarus carinatus</i>	Purple tea mite
<i>Aculops lycopersici</i>	Tomato russet mite
Harmonia axyridis	Asian lady beetle
<i>Cactoblastis cactorum</i>	cactus moth or nopal moth
<i>Aedes albopictus</i>	Asian tiger mosquito or forest day mosquito
<i>Solenopsis invicta</i>	red imported fire ant
<i>Melanoides tuberculatus</i> ,	Red-rimmed melania

### **Birds**

<i>Passer domesticus</i>	House sparrow
<i>Agapornis sp.</i>	Lovebird
<i>Corvus splendens</i>	Indian house crow
<i>Alopochen aegyptiacus</i>	Egyptian Goose
<i>Sturnus vulgaris</i>	Common Starling

### **Fishes**

<i>Lates niloticus</i>	Nile perch
<i>Oreochromis mossambicus</i>	Mozambique tilapia
<i>Cyprinus carpio</i>	Common carps
<i>Oreochromis niloticus</i>	Nile Tilapia
<i>Oreochromis esculentus</i>	Singida tilapia
<i>Procambarus clarkii</i>	Louisiana crayfish

### **Mammals**

<i>Rattus norvegicus</i>	
<i>Ondatra zibethicus</i>	muskrat
<i>Varanus niloticus</i>	Nile monitor

Annex IX Research Questionnaire

**BASELINE SURVEY ON INVASIVE ALIEN SPECIES IN KENYA**

Invasive alien species (IAS) are key drivers of change in ecosystems. However, their surveillance is more often than not inadequate thus compromising the delivery of ecosystem services. To enhance capacity on the subject in Kenya, EAFRINET, the East African arm of BioNET International has commissioned this survey to identify institutions, projects, experts, initiatives, programmes and databases involved in IAS Research and use. Outputs of this survey will be used to identify national needs in IAS management, mobilize existing resources and most importantly, strengthen local/regional taxonomic partnerships to provide timely and relevant, services in response to emerging environmental challenges.

Your cooperation in completing this questionnaire will be appreciated.

**A. Personal Information**

- 1. Name: \_\_\_\_\_
- 2. Education level: \_\_\_\_\_
- 3. Profession: \_\_\_\_\_
- 4. Institution: \_\_\_\_\_
- 5. Contact Addresses: \_\_\_\_\_

**B. Institutional Information**

- 6. What are the mandate(s) of the institution?
- 7. Are there some activities the institution/department undertakes and/or had undertaken in the area of Invasive Alien Species (IAS)? (Please, list by titles of activities).
- 8. What is the expertise the institution has on IAS? (tick where necessary)  
 Taxonomy    Ecology    Population genetics    Quarantine and disposal  
 Other.....
- 9. Could you mention names of experts (their area of expertise and institution) you know working on IAS in your institution, within and outside the country?
- 10. Does your institution partner/collaborate with other institutions within and outside the country in biodiversity activities?  
 Yes                       No                       I don't know
- 11. If yes in 9 above, has it collaborated/partnered with them on IAS activities?  
 Yes                       No                       I don't know
- 12. If yes in 10 above, could you mention them and list the activities?
- 13. Does the institution have a website?

Yes                       No                       I don't know

14. If Yes, does it have a page for IAS information?

Yes                       No                       I don't know

15. Could you mention future plans the institution has with the website for IAS information?

16. Does the institution have communication strategies and information dissemination channels/networks?

Yes                       No                       I don't know

17. If yes above, could you mention them?

**C. Project/programmes**

18. Has your institution undertaken or is currently implementing any project on IAS?

Yes                       No                       I don't know

If yes please, attend to the table below

	Project/Programme: Title and duration	Geographical Scale (local, national, regional, global)	Target Ecosystems	Target Species	Expected Outputs/ Achievements
1					
2					
3					
4					
5					

19. What is/are the (potential) sources of funding for the projects/programmes?

20. List any partners/collaborators on the project?

21. Who are the end-users of the project outputs and/or regular services on IAS?

**D. Collections and Information management**

22. Do you have depository for biological reference collections?

Yes                       No                       I don't know

23. If yes, which collections do you house?

Zoological               Botanical               None

24. How do you acquire these biological reference collections?

Field sampling     Intentional collection expedition     Donations     Loan/ Exchange   
Confiscation

25. If field sampling and Intentional collection expedition above, what equipment do you use for collection?

26. In what form do you keep biological reference collections?

Dead specimens    Live specimens    Digital    photo plates    Audio  
 Other,  
specify.....

27. How many biological specimens and species do you have in your collection(s)?

Specimens:  0-500    500-1million    1-1.5million    1.5-2million  
 Over 2 million

Species.....

28. Are IAS represented in the collections (below, list and/or estimate number of species)?

Yes                       No                       I don't know

29. Who are the end-users of the reference collections (and information) on IAS?

30. How often do you curate/update your biological reference collections?

Every month    Quarterly    Twice a year    Yearly    continuous  
 Other, specify .....

31. What reference(s) or criteria do you use for identification of IAS?

Literature    Reference collections    guide books    taxonomic ID keys,  
 Internet images    Guide books    Taxonomic ID keys  
 Other, specify .....

32. Are there measures you use for controlling infestation and dispersal of propagules of IAS specimens?

Yes                       No                       I don't know

33. If yes above, check below (measures) where necessary

Quarantine    Incineration    Return to the sender    Roguing    Chemical application    Integrated pest management  
 Other, specify.....

34. How do you register/accession/document data on biological specimens deposited in your reference collections?

Electronic registry (computer)    Manual registry (Hard copy)    None  
 Other,

specify.....

35. What methods do you use for long-term preservation of biological collections (see table below- Mark where necessary)?

Collecti on types	Preservation/curation methods							
	e.g. Stuffing /skinning	e.g. Formalin, Alcohol	e.g. Refrigeration	e.g. Gel	e.g. Drying, Mounting	Cultivation , quarantine	Slide mounting	Culture
Plant specimens								
Mammals								

Fish								
Birds								
Reptiles/ Amphibi ans								
Microorg anisms								
Tissues								

36. What storage facilities do you use for keeping biological collections?  
 Cabinets  Jars  Shelves  Freezer  Other, specify.....
37. Are there deaccession/disposal procedures for IAS materials?  
 Yes  No  I don't know  
 a. If yes, could you explain the procedure(s)?
38. Is information on biological collections stored in a database?  
 Yes  No  I don't know  
 a. If yes, which software do you use for database management?  
 b. If yes (above), where does the database exist?  
 Central location  Departments/sections  Individuals  Other?.....  
 c. If yes how often do you update the database?  
 Every month  Quarterly  Twice a year  Yearly  continuous  
 Other, specify
- 39 Do you have security back-up for the database information?  
 Yes  No  I don't know  
 d. If yes in 26 above, how do you back up the data?
39. Could you mention future plans for improving database?
40. What publications do you possess on IAS in your library? Could you list them?
41. Is internet facility available, and accessible at your institution?  
 Yes  No  I don't know
42. If yes above, how efficient is the internet?  
 Fast  Moderate  Slow  Intermittent
43. Are you aware of any online database on IAS within and outside the country?  
 Yes  No  I don't know  
 a. If yes, could you mention them?  
 b. If yes above, do you access/use any of the online databases in your regular activities?  
 Yes  No  I don't know  
 c. If yes (above), which one do you often use?  
 d. If yes, how often do you use it?  
 Regularly  Occasionally  I don't know
44. What are challenges you experience in curation of biological references and information management collections with regard to:  
 a. Storage :

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- Space     Storage facility     Ventilation     Other, specify .....
- b. Skills:
  - Identification     Preservation     Maintenance of collection     Other, specify .....
- c. Acquisition of materials:
  - Transport     Field inaccessibility/security     Lack of sampling equipments
  - Imaging equipment     Other, specify .....
- d. Information management (database):
  - Expertise     Software     Hardware     Data sharing     Other, specify .....
- e. Security:
  - Theft     Piracy     Fire     Bio-security (threats due natural propagules dispersal
  - Other, specify .....
- f. Pests:
  - Infestation of collections     Damage of storage facility     Risk to human health

Thank you for taking time to complete this questionnaire

Date: \_\_\_\_\_

**Annex X List of People contacted**

<b>Name</b>	<b>Institution</b>
Mr. Victor Wasonga	NMK
Mr. Bernard Agwanda	NMK
Mr. Simon Kangethe	NMK
Dr. Dorothy Nyingi	NMK
Mr. Henry Roimen	DRSRS
Mr. Itambo Malombe	NMK
Dr. Wanja Kinuthia	NMK
Mr. Arne Witt	CABI
Mr. Charles Muthama	KMFRI
Mr. Alex Ngari	Nature Kenya
Ms. Esther Fondo	KMFRI
Mr. Dalmas Otieno	KWS
Ms Agnes Muthumbi	University of Nairobi
Mr. Parkinson Ndonge	NEMA
Dr. Charles Lange	NMK
Mr. Frank Msafiri	DRSRS
Mr. Staline Kibet	NMK
Dr. Geoffrey Howard	IUCN
Ms. Phillista Malaki	NMK
Mr. Dan Marangu	DRSRS
Mr. Caleb Obunyali	KEPHIS
Mrs. Hottensiah Mwangi	KARI/NARL
Ms. Teresia W. Karanja	KARI
Mr. James Mathenge	KWS
Ms. Pamela Kibwage	KEPHIS
Mr. Abed Kagundu	KEPHIS
Dr. Siro Masinde	ALUKA
Dr. Samuel Andanje	KWS
Ms. Teresa Kinyungu	Ministry of Agriculture
Mr. Bernard Kamondo	KEFRI