



**THE UNITED REPUBLIC OF TANZANIA
VICE PRESIDENT'S OFFICE**

**NATIONAL INVASIVE SPECIES
STRATEGY AND ACTION PLAN (NISSAP)
(2019 - 2029)**



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JUNE, 2019



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FOREWORD

Tanzania is one of few countries endowed with natural resources rich in biodiversity. Like many other developing countries, Tanzania's development largely depends on the use of its natural resources for ecosystem services. For example, the livelihoods of about 80% of rural population depend on land for agriculture and livestock grazing. The country economy mostly depends on agriculture, which accounts for more than one quarter of GDP and provides 85% of exports. The livestock sector contribute about 4% of the GDP, with an estimated population of 30.5 million cattle, 18.8 million goats, 5.3 million sheep, 1.9 million pigs, 38.2 million local chickens, 36.6 million commercial chickens and 0.6 million donkeys. About 90% of major livestock feed resources come from the rangelands of about 50 million ha of which land for grazing is about 10.5%. Tourism sector has been a major source of foreign revenue contributing up to 17.5% of the GDP and providing about 4.3% of total employment in Tanzania.

While the aforementioned economic sectors are important for our country's development, the natural systems they depend on are threatened by invasive species. The current data indicate that, there are 75 invasive and 145 potentially invasive, altogether making a total of 220 species in the country, which may result to increased threat on the country's natural ecosystems. Currently, the natural vegetation in wildlife reserved areas such as National Parks and Ngorongoro Conservation Area is being replaced by invasive species, disrupting the resilience of wildlife habitats, affecting animal distribution and abundance which ultimately affect tourism. In some reserved forest such as Kimboza Forest Reserve, invasive species are replacing native species affecting natural biodiversity and ecosystem services. Furthermore, more than 350 indigenous fish species have disappeared since the introduction of Nile Perch and water hyacinth in Lake Victoria, posing serious threats not only to the biodiversity of the Lake but also interfering with transportation in the Lake. Generally, biological invasions are serious threats to people's livelihoods, livestock, health and biodiversity conservation. The problem of invasive species is therefore a matter of grave concern to the country.

Management of invasive species in Tanzania started several decades ago through fragmented efforts by various conservation institutions. By the year 2000 various sectoral acts, policies and guidelines were enacted, and some did include issues of invasive species. However, the outcomes of these efforts are difficult to gauge due to lack of a national strategy on invasive species. Sectoral approaches currently used in the management of biological invasions in the country have not been effective enough in managing the ever increasing invasions. In some instances, these approaches have resulted in duplication of efforts and reduction of efficiency. Therefore, there is a strong need for a national strategy which among others will provide effective and coordinated framework for prevention further introduction and spread of invasive species as well as to develop sustainable plans to managing the existing and potential invasions.

This Strategy provides an overview of invasive species in Tanzania, their impacts, existing and potential plans for management. It addresses the important aspects related to introductions, pathways, and management options of priority invasive species in each sector. Important aspects such as the need for effective intra- and- inter sectorial communication and co-ordination; improved operationalization and enforcement of laws and regulations; and capacity building in research and monitoring have also been covered in the Strategy.

I call upon all stakeholders to participate fully in the implementation of the National Invasive Species Strategy and Action Plan in order to prevent new introductions and reduce the impacts of existing invasions so as to improve community livelihoods while ensuring environmental sustainability for the present and future generations



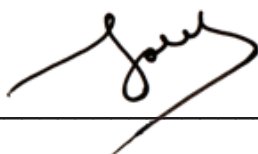
George B. Simbachawene (MP)
Minister of State, Vice President's Office
(Union Affairs and Environment)

ACKNOWLEDGEMENT

The development of this Strategy was initiated and supported by the Vice President's Office. The Minister of State-Union Affairs and Environment by then Hon. January Makamba (MP) took an upper hand to establish a National Task Force which was officially inaugurated on 28th September, 2018 by Hon. Samia Suluhu Hassan, the Vice President of the United Republic of Tanzania. Thanks to various Sectorial Ministers and Permanent Secretaries that took part in the initial and consultative meetings and who have been tirelessly involved in the accomplishment of this Strategy. My sincere gratitude goes to the Multi Sectoral Task Force and the Technical Review Panel, under the co-ordination of the Vice President's Office, Division of Environment. These include experts from the President's Office–Regional Administration and Local Government Authority; Vice President's Office; Ministry of Agriculture; Ministry of Water; Ministry of Natural Resources and Tourism; Ministry of Livestock and Fisheries; University of Dar es Salaam–Institute of Resource Assessment; Sokoine University of Agriculture-College of Forestry, Wildlife and Tourism; Tanzania Wildlife Research Institute; Tanzania Wildlife Management Authority; Tanzania Forestry Research Institute; Tanzania Fisheries Research Institute; The Nelson Mandela African Institution of Science and Technology; College of African Wildlife Management-Mweka; Tanzania National Parks; Ngorongoro Conservation Area Authority; Tanzania Commission for Science and Technology and Tropical Pesticide Research Institute.

I also extend my sincere gratitude to all stakeholders for their valuable inputs during field surveys, data collection and during the consultative workshop in Morogoro. Special thanks go to all who were involved in reviewing the draft reports of the strategy.

Finally, I thank the Ngorongoro Conservation Area Authority; Tanzania National Parks Authority; Tanzania Forest Services Agency, Tanzania Forest Fund; World Wide Fund for Nature; and USAID PROTECT for their financial support.



Eng. Joseph K. Malongo

Permanent Secretary, Vice President's Office

EXECUTIVE SUMMARY

This Strategy was developed in response to the growing concern on the negative impacts of Invasive Species (IS) to the country's economy, socio-cultural aspects, human and animal health as well as physical environment. Invasive species cause major economic, environmental and social impacts in Tanzania. The IS are among of the serious threats to biodiversity; crop and pasture production; human and animal health; water resources and economic development. It has been estimated that the invasion by five IS in mixed maize farming systems has costed Tanzania about US\$ 155.6-190 million dollars. Moreover, it has been established that Tanzania National Parks and Ngorongoro Conservation Area Authority spend more than TZS 1 billion annually to control IS. Such a large amount of money spent for fighting IS could have been used to invest in development activities.

The Minister responsible for Union Affairs and Environment by then, Hon. January Makamba (MP), therefore decided to organize stakeholders meeting in Arusha on 4th September, 2018 during which the need for a National Task Force (NTF) on IS was given emphasis. It was agreed that, among others, the NTF should develop a National Invasive Species Strategy and Action Plan (NISSAP) for Tanzania. Thus the NTF was formed and officially inaugurated on 28th September, 2018 by Hon. Samia Suluhu Hassan, the Vice President of the United Republic of Tanzania.

A survey by NTF on invasive species found 75 invasive and 145 potential invasive species, a total of 220 species in the country. This large number of species makes Tanzania vulnerable to IS risk on human and natural resources. There has been little success of efforts taken to manage IS in Tanzania due to:- increased international trade, low awareness, insufficient human and financial capacity, lack of effective control methods and lack of specific regulations for management and coordination of IS. Furthermore, climatic changes and unsustainable land use practices exacerbated by increase in human activities are expected to increase the number and spread of IS across the country.

This document therefore presents the national strategy for managing invasive species in Tanzania, over a time horizon of 10 years (2019-2029). The strategy constitutes a national-level plan for the cost-effective achievement of the specific objectives in an environment of uncertainty.

Various methods were used in developing the Strategy. A rigorous literature review was undertaken to obtain information on types and number of IS, pathways, impacts, existing management practices as well as regional and international efforts. Existing legislatives and institutional frameworks in Tanzania were reviewed to ensure that the strategy was carried out in line with the existing legal and regulatory frameworks, but also to identify strengths and gaps that need to be covered for a successful implementation of this Strategy. Additionally, field visits were conducted to some agro-ecological zones of Tanzania. The selection of sites for field visits was based on available information on invasive species. Individuals/ organizations known to have information on invasive species were purposively contacted and/or visited. A consultative workshop was carried out to seek for stakeholders' opinions and inputs on the strategy before the final draft was produced.

The strategy contains six strategic objectives to be implemented over the period of 10 years. The targets and actions for each strategic objective were developed as summarised below:

OBJECTIVE 1: PREVENT INTRODUCTION AND SPREAD OF NEW INVASIVE SPECIES

Target 1.1 *At least 90% of all biological materials introduced to Tanzania are inspected against IS threats by 2024*

- Action 1.1.1 Identify and manage priority pathways and vectors of IS introduction and spread*
- Action 1.1.2 Conduct risk assessment of potential IS*
- Action 1.1.3 Strengthen and Enforce Regulations dealing with importation and movement of live materials at national and regional/international borders*
- Action 1.1.4 Capacitate border posts with adequate resources to manage invasive species*
- Target 1.2 At least 95 % of emerging IS are detected and eradicated by 2029**
- Action 1.2.1 Develop and implement EDRR procedures for IS management*
- Action 1.2.2 Develop and implement a national surveillance system for managing IS*
- Action 1.2.3 Develop and disseminate invasive species “watch lists”*

OBJECTIVE 2: REDUCE NEGATIVE IMPACTS OF EXISTING PRIORITY INVASIVE SPECIES

- Target 2.1 The abundance and spread of all national priority invasive species are reduced by at least 50% by 2029**
- Action 2.1.1 Identify, map and reduce abundance of IS in their established and invaded areas*
- Action 2.1.2 Building on the management know-how from within and other countries*
- Action 2.1.3 Develop and promote integrated approaches to control IS*
- Action 2.1.4 Develop and strengthen a centralized national IS database*
- Target 2.2 At least 50% of critical ecosystems impacted by invasive species are restored by 2029**
- Action 2.2.1 Integrate restoration actions in all IS management approaches*
- Action 2.2.2 Develop and implement framework for restoration of degraded areas by invasive species*
- Action 2.2.3 Build and strengthen community capacity to conduct restoration of degraded ecosystems*
- Target 2.3 At least 50% invasive species management efforts are monitored and evaluated by 2029**
- Action 2.3.1 Develop and implement a national IS management monitoring and evaluation framework*
- Action 2.3.2 Improve existing monitoring standards and protocols for managing IS*

OBJECTIVE 3: ENHANCE NATIONAL CAPACITY TO MANAGE AND RESEARCH ON INVASIVE SPECIES

- Target 3.1 At least 70% of fund proposed for management of invasive species is secured and implemented by 2024**
- Action 3.1.1 Leverage funds to address IS management*
- Action 3.1.2 Develop fund allocation guidelines for managing IS*
- Action 3.1.3 Establish an emergency response funding model for managing IS*
- Target 3.2 By 2025, research on invasive species increased by 50%**
- Action 3.2.1 Support research on priority IS and areas*
- Action 3.2.2 Mainstream IS management into existing research agenda of academic, research and development institutions*
- Action 3.2.3 Strengthen National Environmental Trust Fund for funding research on IS*

OBJECTIVE 4: ENHANCE STAKEHOLDER'S EDUCATION AWARENESS AND PARTICIPATION ON MANAGEMENT OF IS

Target 4.1 *At least 50% of stakeholders are aware of various invasive species management options by 2024*

Action 4.1.1 Develop and implement community educational and awareness programs on IS management

Action 4.1.2 Promote behavioural change to mitigate introduction and spread of IS

Action 4.1.3 Mainstream IS modules from primary to higher learning institutions

Action 4.1.4 Strengthen technical capacity of Extension Service Providers on IS management

Target 4.2 *At least 50% of stakeholders participated in managing invasive species by 2024*

Action 4.2.1 Mainstream IS management into national communication strategy

Action 4.2.2 Recognize and award exemplary performance in IS management

Action 4.2.3 Incorporate IS management actions in national and international environmental events

Action 4.2.4 Create consistent and timely messaging platforms on IS management

OBJECTIVE 5: MAINSTREAM INVASIVE SPECIES MANAGEMENT INTO REGULATORY TOOLS

Target 5.1 *At least 50% of all regulatory tools in Tanzania are revised and operationalized by 2022*

Action 5.1.1 Review and mainstream IS management into regulatory tools

Action 5.1.2 Harmonize conflicting regulatory tools for managing IS

Action 5.1.3 Mainstream IS issues into local charters, sectorial ministries, local government and private sector plans and guidelines

Target 5.2 *All existing regulatory tools dealing with invasive species management are enforced effectively by 2020*

Action 5.2.1 Identify and capacitate agencies responsible for enforcement of regulatory tools on invasive species

Actions 5.2.2 Develop risk assessment process for effective enforcement of regulatory tools

Action 5.2.3 Define roles and responsibilities of all agencies responsible for regulating invasive species

OBJECTIVE 6: STRENGTHEN AND PROMOTE STRONG COLLABORATION AND CO-ORDINATION WITH STAKEHOLDERS ON MANAGEMENT OF INVASIVE SPECIES

Target 6.1 *By 2025, collaboration and coordination on the management of IS among stakeholders increased by at least 50%*

Action 6.1.1 Strengthen trans-boundary partnerships on the management of IS

Action 6.1.2 Establish coordination and communication mechanism for effective management of invasive species to all relevant stakeholders.

Target 6.2 *By 2025, collaboration and co-ordination on the management of IS among stakeholders promoted by at least 50%*

Action 6.2.1 Develop and implement an effective system for collaboration and coordination on IS management among stakeholders

Action 6.2.2 Monitor and evaluate cross-sectorial coordination and collaboration on the IS management

Action 6.2.3 Develop and implement a framework for quarterly reporting on IS issues

The actions were categorized into three levels of implementation priorities namely: Critical, high priority and medium priority actions. *Critical actions* are those essential to successful implementation of the Strategy and should be implemented immediately after the endorsement of the Strategy. *High priority actions* are those essential to the successful implementation of the Strategy and should also be initiated as soon as possible but their implementation is contingent upon prior actions being undertaken; and *medium priority actions* are actions that are deemed important but not essential for successful implementation of the Strategy. Strategies for long-term management of invasive species will mean deriving lessons and feedback from the implemented short-term strategies. These will then be used to develop long-term forecasting of managing the invasion process and mechanisms that are beyond the already emerged and spread of existing invasive species and this would include aspects such as climate change, population increase, increased free market economy and unsustainable land conversion.

The Implementation of the NISSAP will be guided by the National Environmental Management Act (EMA), 2004. The overall coordination, communication and reporting of the Strategy will be under the Vice President's Office (VPO), Division of Environment, Biodiversity and Conservation. The implementation of the strategy over a period of 10 years is estimated to cost a total of TZS 73.86 billion. The funds are expected to be raised from the government and various development partners.

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DEFINITION OF TERMS

Alien species	species, subspecies or lower taxon whose presence in a region is attributable to human actions that enabled it to overcome fundamental biogeographical barriers.
Biological diversity (Biodiversity)	variability among living organisms and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems.
Biological invasions	phenomenon of, and suite of processes involved in determining, the following: i) the transport of organisms, through human activity, to areas outside the potential range of those organisms as defined by their natural dispersal mechanisms and biogeographical barriers; and ii) the fate of such organisms in their new ranges, including their ability to survive, establish, reproduce, disperse, spread, proliferate, interact with resident biota and exert influence in many ways on and in invaded ecosystems.
Control	reducing the population of an invasive species.
Ecosystem	a community of organisms interacting with one another and with the environment in which they live.
Ecosystem services	benefits essential to human survival that natural ecosystems provide through their structures and functional processes.
Endemic species	unique species not naturally found elsewhere.
Eradication	permanent removal of the entire population of a species within a specific time and area.
Establishment	the process of a species in a new habitat successfully producing viable offspring with the likelihood of continued survival.
Established species (Naturalized species)	alien species that sustain self-replacing populations for several life cycles or a given period of time without direct intervention by people, or despite human intervention.
Impact	description or quantification of how an alien species affects the physical, chemical and biological environment. Impact can be conceptualized as the product of the range size of the invader, its average abundance per unit area across that range and the effect per individual or per biomass unit of the invader.

Introduction	the movement by human agency, indirect or direct, of a species outside of its natural range (past or present). This movement can be either within a country or between countries or areas beyond national jurisdiction.
Intentional introduction (Deliberate introduction)	the deliberate movement and/or release by humans of an alien species outside its natural range.
Introduced species	Plants, animals and other organisms taken beyond their natural range by people, deliberately or unintentionally.
Invasive Alien species	species introduced deliberately or unintentionally outside their natural habitats where they have the ability to establish themselves, invade, out-compete natives and take over the new environments. These are also referred to as species whose introduction and/or spread threaten biological diversity.
Key sectorial ministries	sectors affected by IS in each of the ministries in which they fall.
Management	activities related to prevention, Early Detection and Rapid Response (EDRR), and Control of invasive species.
Native species (Indigenous species)	a species that have evolved in a given area or that arrived there by natural means (through range expansion), without the intentional or accidental intervention of humans from an area where they are.
Naturalization (establishment)	the process of establishment of an alien species in its area of introduction.
Pathways (also invasion pathways)	means that allows the entry or spread of an invasive species.
Sanitary and phytosanitary measures	measures applied to protect human, animal or plant health in an area or region of introduction, establishment or spread of pests, diseases or vectors.
Regulatory tools	National Policies, Acts and Regulations.
Restoration	efforts to re-establish the biodiversity, ecosystem functioning and ecosystem services in a degraded area to the state that existed before degradation.
Rehabilitation	reparation of ecosystem processes, services, and productivity but it does not mean to restore the ecosystem to its pre-existing condition.

Surveillance	monitoring for the purpose of detecting the arrival of new invasive species.
Sustainability	maintaining or improving the functioning of social-ecological systems, including environmental sustainability, the wellbeing of society and economic prosperity.
Unintentional introduction	refers to all introductions of invasive species which are not intentional.
Vectors	agents responsible for the transport of species to new areas where they did not previously occur.

ABBREVIATIONS AND ACRONYMS

AEWA	African-Eurasian Migratory Water Bird
CABI	Centre for Agriculture and Biosciences International
CAWM	College of African Wildlife Management-Mweka
CBD	Convention on Biological Diversity
CBO	Community-Based Organization
COSTECH	Tanzania Commission for Science and Technology
CSO	Civil Society Organization
DE	Director of Environment
EDRR	Early Detection And Rapid Response
IAS	Invasive Alien Species
IRA	Institute of Resource Assessment
IS	Invasive Species
ISSG	Invasive Species Specialist Group
ISPM	International Standard for Phytosanitary Measures
IUCN	International Union for Conservation of Nature
LVEMP	Lake Victoria Environmental Management Programme
MDA	Ministries, Departments and Agencies
MLF	Ministry of Livestock and Fisheries
MLND	Maize Lethal Necrosis Disease
MOA	Ministry of Agriculture
MNRT	Ministry of Natural Resources and Tourism
MP	Member of Parliament
NBSAP	National Biodiversity Strategy and Action Plan
NCA	Ngorongoro Conservation Area
NCAA	Ngorongoro Conservation Area Authority
NEAC	National Environmental Advisory Committee
NEMC	National Environment Management Council
NGO	Non-Governmental Organization
NISSAP	National Invasive Species Strategy and Action Plan
NM-AIST	The Nelson Mandela African Institution of Science and Technology
PORALG	President's office Regional Administration and Local Government Authority
PROTECT	Promoting Tanzania's Environment, Conservation and Tourism
PRA	Pest Risk Assessment
SADC	Southern African Development Community
SDG	Strategic Development Goals
SUA	Sokoine University of Agriculture
SWOC	Strengths-Weaknesses-Opportunities-Challenges
TaFF	Tanzania Forest Fund
TAFIRI	Tanzania Fisheries Research Institute
TAFORI	Tanzania Forestry Research Institute

TALIRI	Tanzania Livestock Research Institute
TANAPA	Tanzania National Parks Authority
TAWA	Tanzania Wildlife Management Authority
TAWIRI	Tanzania Wildlife Research Institute
TFS	Tanzania Forest Service's Agency
TLU (ha/LU/yr)	Tropical Livestock Unit (hector/Livestock Unit/years
URT	United Republic of Tanzania
TPRI	Tropical Pesticide Research Institute
VPO	Vice President's Office
GISP	Global Invasive Species Programme
WWF	World Wide Fund for Nature

INTRODUCTION

1.1 Background

Tanzania is one of few countries endowed with natural resources rich in biodiversity. Like many other developing countries in the world, Tanzania's development largely depends on the use of its natural resources for ecosystem services. For example, the livelihoods of about 80% of rural population depend on land for agriculture and livestock grazing. The country economy mostly depends on agriculture, which accounts for more than one quarter of GDP and provides 85% of exports. The livestock population which is estimated at 30.5 million cattle, 18.8 million goats, 5.3 million sheep, 1.9 million pigs, 38.2 million local chickens, 36.6 million commercial chickens and 0.6 million donkeys, contribute about 4% of the GDP (MLF, 2017). The major feed resources (90%) come from the rangelands of about 50 million ha of which land for grazing is about 10.5% (NAFORMA, 2015).

While the aforementioned economic sectors are important for our country's development, the natural systems they depend on are threatened by invasive species. Invasive species have major ecological health and economic impacts in Tanzania. Impacts include threat to biodiversity, crops and pasture production and water resources. For example, invasion by *Cedrela odorata* in Kimboza Forest Reserve has colonized larger part of the forest and replaced native species, including the habitat of critically endangered Turquoise Dwarf Gecko (*Lygodactylus williamsi*) (Flecks *et al.*, 2012). The invasion of *Astripomoea spp* (Kongwa weed) and *Chromolaena spp* (Amacha-bongo) in grazing lands reduce forage availability that causes livestock weight loss and encourages mobility among pastoralists in search for pastures elsewhere which ultimately causes conflict with other rangeland users. Furthermore, more than 350 indigenous fish species have disappeared since the introduction of Nile Perch and water hyacinth in Lake Victoria, creating a serious threats not only to the biodiversity of the Lake but also interfering with transportation in the Lake. The health impacts occur in both human and animals. Some of IS such as *Parthenium hysterophorus* have been described to cause health problems to both human and animals. *Parthenium hysterophorus* causes allergenic rhinitis, asthma, bronchitis, dermatitis, and hay fever to humans (Gnavel, 2013).

With regards to economic loss, for example in Tanzania, it has been estimated that the invasion by five major IS in mixed maize farming systems is already costing Tanzania economy about US\$ 155.6-190 million a year (Pratt *et al.* 2017). It has also been established that Tanzania National Parks (TANAPA) and Ngorongoro Conservation Area Authority (NCAA) has spent more than 1 billion Tanzanian shillings for managing IS in the financial year 2018/2019. Such large amounts of money set aside to fight IS could have been directed to improve infrastructures in the tourism sector and contribute to the national economy. Generally, biological invasions pose serious threats to people's livelihoods, livestock, health and biodiversity conservation. The problem of IS is therefore a big challenge to the country. This Strategy therefore provides means and ways to manage the negative impacts caused by invasive species.

1.2 Rationale

Tanzania has ratified international conventions and enacted national legislations which are focused at addressing IS. The country ratified the International Plant Protection (IPP) Convention since 1951 in order to facilitate inspection of consignments with plants and/or plant parts moving across international borders. To operationalize the IPP convention, the Plant Protection Act (1997) and Regulations (1998) were enacted. Section 8 (1) of the Act

requires that no plant or plant products, harmful organism, beneficial organism, or soil, may be imported into Tanzania except in accordance with the conditions on a plant importation permit previously obtained from, and signed by the Inspector in-charge. Furthermore, in 2003, Tanzania enacted another act to prevent and control animal diseases (Animal Diseases Act No 17 of 2003). The Act makes provision for control and prevention of animal diseases, monitoring production of animal products, for disposal of animal carcasses and for other related matters.

While the legislative and regulatory environment to prevent introduction of IS in Tanzania are in place, there exist a number of shortcomings that lead to low effectiveness in IS management:

- Inspection agencies have inadequate equipment such as diagnostic tools for inspections. Currently inspection is based on visual assessment, hand lenses or simple microscope, which may be difficult to identify pests and seeds.
- Regulation of cross-border movement of livestock has often been viewed by the public as a political rivalry between neighbouring countries rather than a regulatory process to prevent introduction of IS.
- Low awareness among communities and experts including those responsible for importation procedures of biological materials.
- Inadequate human and financial capacity.

Furthermore, there have been inadequate enforcement of available legislations on IS which are under specific sectors, this is due to low knowledge and skills on how to identify species, quantify impacts and control/manage IS. There is also lack of co-ordinated effort among sectors on managing IS, leading to highly fragmented efforts. Some of the economic sectors have not included issues of IS in their regulatory tools hence pose challenges in enforcement.

Thus in view of the existing inadequacies, there is strong need for a national strategy which among others will guide towards an effective and coordinated framework and efforts to prevent further introduction, spread of invasive species as well as to develop sustainable solutions to manage the existing invasions. The strategy also addresses the important aspects related to introduction, pathways and management options of the priority invasive species in each sector. Important aspects such as the need for effective intra and inter sectorial communication and co-ordination; improved operationalization and enforcement of laws and regulations; and capacity building in research and monitoring are also covered in the Strategy.

In his recognition of the negative impacts of IS on the environment and in many sectors of Tanzania's economy including the socio-cultural impacts, the Minister responsible for Union Affairs and Environment Hon. January Makamba (MP), made visits to some of the areas affected by IS in the country to understand the scale of the problem and efforts undertaken to address it, in order to form a basis for finding long term solutions. It is from these visits, Hon. Makamba decided to call stakeholders meeting in Arusha on 4th September 2018 during which that the need for a National Task Force (NTF) on IS was highly emphasized, and was proposed that the NTF should develop a National Strategy and Action Plan to Manage Invasive Species (NISSAP).

In response to the resolutions of the stakeholders meeting, the Minister of Union Affairs and Environment, Hon. Makamba elected NTF that was officially inaugurated on 28th September 2018 by Hon. Samia Suluhu Hassan, Vice President of the United Republic of Tanzania (Appendix 1). A total of 14 Terms of References (ToRs) were assigned to the NTF team by the Vice President including six which emerged during the inauguration session. Among the expected deliverables was a National strategy and action plan for managing IS.

1.3 The NISSAP formulation process

Various approaches, methods and techniques were used both in combination and/or singly to generate information and data used in the preparation of this Strategy. These include; learning and understanding the terms of references/tasks assigned to the team, preparation of an Inception Report and consulting key stakeholders. A table indicating areas visited during stakeholders consultations and list of reviewed research projects on IS is presented on Appendix 2 & 3 respectively. The steps involved in development of this NISSAP listed below: -

- 1) Review of existing information on IS in gray and published literature,
- 2) Review of existing legislatives and institutional frameworks and strategies on invasive species for Tanzania and other countries,
- 3) Consultation with key stakeholders using focused group discussions and field visits across sectors and geographical areas in Tanzania
- 4) Review by relevant experts, the scientific knowledge on issues related to IS,
- 5) Stakeholders' consultative workshop.

Rigorous literature review was undertaken to identify the existing information on type, number, pathways, impacts, management practices, legislatives and institutional frameworks on IS. Existing legislatives and institutional frameworks in Tanzania were reviewed to identify strengths and gaps that can be working out for insuring that the strategy comply with legal and regulatory frameworks (Appendix 4). Literature on preparation of such strategies was also consulted in order to get a regional and international format and also mainstream cross-cutting issues.

Extensive consultation with key stakeholders was conducted to obtain information not available in the publications. At least 50 key stakeholders were consulted either through face to face discussions or through questionnaire administered through e-mail as indicated in Appendix 5 & 6. The selection of the stakeholders was based on experience in issues related to IS or impacted sectors/communities.

The draft NISSAP document was subjected to review sectoral and institutional experts at a structured consultative workshop. The workshop was attended by 34 participants representing crosscutting sectors, NGOs, private sector, academic and research institutions within Tanzania, who shared their knowledge and skills to improve the draft NISSAP. A list of the participants who attended the workshop has been attached hereto as Appendix 7.

1.4 Structure of the NISSAP

This Strategy is divided into five chapters.

Chapter one is introduction. This chapter provides background information on IS including scale of the problem and its impacts. This chapter also provides information on the genesis and rationale for the strategy and the process of formulating the strategy.

Chapter two provides the current state of invasive species in Tanzania. In particular this chapter provides a list of invasive and potential invasive species for Tanzania and through a set of criteria identifies a list of priority IS for interventions. This chapter identifies pathways for IS introduction and vectors for spread in the country. It also provides information on impacts of invasive species on the economy, environment, human and animal health and existing approaches to management of IS in Tanzania. The chapter also provides analysis of policy, legislative and regulatory tools so as to show the existing gap and propose areas

for improvement on issues of IS. The analysis identified those regulatory tools which fully address issues of IS, partially address and those which do not address issues of IS. The results of this analysis have been used to set objectives and targets to be addressed in the Strategy. In addition, this chapter presents the proposed plans for management of IS in Tanzania. Generally, the chapter provide baseline information of the problem mentioned in the rationale section and highlight the need to be addressed in the Strategy.

Chapter three is the strategic plan. This chapter, based on information from situational analysis provides the vision, mission and goal for the Strategy. It also provides six strategic objectives and actions required for each strategic objective. This chapter also presents the logical framework matrix which summarizes strategic objectives, actions, provides timelines for implementation and identifies responsibilities and indicators of performance.

Chapter four is the implementation, monitoring and evaluation plan for the NISSAP. It provides information required for successful implementation of the Strategy. Such information includes: Prioritization of actions and areas, coordination, monitoring, evaluation and learning.

Chapter five is the indicative expenditure budget. This chapter specifically intends to provide the government and all relevant stakeholders with the clue on the potential budget that may be required to implement the NISSAP for the period of 10 years.

2.0 SITUATIONAL ANALYSIS

2.1 CURRENT STATUS OF INVASIVE SPECIES IN TANZANIA

There is inadequate documentation of the current status of invasive species in Tanzania (Ngondya *et al.*, 2017). Most of the fairly documented invasive species are those which have impacted the forest and wildlife sectors. Little is known about IS in other sectors such as livestock, agriculture, water, health and fisheries. Following this gap, the Task Force Team undertook an assessment of the current list of IS in each sector and prepared a master list across all sectors. The Task Force Team appreciate some of the existing standard definitions of alien species, native species and invasive species. However, for convenience, these key terms were customized considering the Tanzanian context as shown in text Box 1.

Box 1: Customized definitions

- i) *Alien species refer to a species, subspecies or lower taxon whose presence in a region is attributable to human actions that enabled it to overcome fundamental biogeographical barriers*
- ii) *Native species refer to a species that have evolved in a given area or that arrived there by natural means (through range expansion), without the intentional or accidental intervention of humans from an area where they are native*
- iii) *Invasive species means all species (alien and native) that were found to have the following characteristics: 1) wide spread and abundant or localized but abundant, 2) high rate of spread, and 3) cause negative impacts to economy, environment or health*
- iv) *Potential invasive species means alien species that have been recorded as invasive in other countries but have not yet displayed the invasiveness characteristics (as described above (iii)) in Tanzania*

The NTF conducted a critical review of existing of various databases, publications and reports on IS, consultations with other experts and field surveys to some of areas known to be affected by IS. The analyses of data from various databases, review of publications, field surveys and expert information found that, currently Tanzania has a total of 220 invasive and potential invasive species (Table 1, Appendix 8). Seventy five (75) are invasive species, of which 87% are aliens and 13% native (Table 1, Appendix 9). The alien invasive species (AIS) fall under various life forms: animals (15), plants (49) and fungi (1). However, native invasive species (NIS) fall only under one life form: plants (10). Out of the 145 potential invasive species, approximately 94% were alien plant species (Appendix 10). About one third (32%) of the potential invasive alien plants are found in protected areas (Table 2). The NTF recommends immediate control of these species so as to avoid future spread to other areas and affect the integrity of the natural protected ecosystems. It is also worth noting that of the potential invasive species, 8 species (3 animal and 5 plant species) are species native to Tanzania.

Table 1: Invasive and potential invasive species of Tanzania

Organism	Invasive		Potential invasive		Total
	Alien	Native	Alien	Native	
Animalia	15		21	3	39
Bird	1			1	2
Fish	6		14	1	24
Insect	7		5	1	13
Mammal	1				1
Mollusca			2		
Fungi	1		1		2
Fungi			1		2
Plantae	49	10	115	5	179
Aquatic	3				2
Algae			3		4
Bamboo	1				
Cactus	2		1		3
Climber	1	1	4		6
Fern	2		1		3
Grass	3		8	3	13
Herb	11	6	40	1	61
Palm	3		2		4
Shrub	7	2	15		23
Tree	16	1	41	1	55
Grand Total	65	10	137	8	220

Table 2: List of species found in protected areas of Tanzania

S/N	Scientific name	Common name	Local Name	Life form	Organism	Alien/ Native
1	<i>Agave sisalana</i>	Sisal plant	Katani, mkonge	Herb	Plantae	Alien
2	<i>Amaranthus hybridus</i>	Green amaranth	Mchicha pori	Herb	Plantae	Alien
3	<i>Amphidinium carterae</i>			Algae	Plantae	Alien
4	<i>Anacardium occidentale</i>	Cashew tree	Mkorosho	Tree	Plantae	Alien
5	<i>Annona senegalensis</i>	African custard-apple	Mandopi, Mdape, Msirisiri,	Tree	Plantae	Alien
6	<i>Artocarpus heterophyllus</i>	Jackfruit	Mfenesi	Tree	Plantae	Alien
7	<i>Arundo donax</i>	Giant cane		Grass	Plantae	Alien
8	<i>Austrocylindropuntia subulata</i>	Devil's rope, long-spine cactus		Cactus	Plantae	Alien
9	<i>Azadirachta indica</i>	Nimtre, Indian lilac	Mwarobaini	Tree	Plantae	Alien
10	<i>Bidens kilimandscharica</i>	Bidens		Herb	Plantae	Alien
11	<i>Camellia sinensis</i>	Tea plant	Chai	Shrub	Plantae	Alien
12	<i>Capsella bursa-pastoris</i>	Coffee senna		Herb	Plantae	Alien

S/N	Scientific name	Common name	Local Name	Life form	Organism	Alien/ Native
13	<i>Cascabela thevetia</i>	Yellow oleander		Shrub	Plantae	Alien
14	<i>Cassia occidentalis</i>	Coffee senna		Shrub	Plantae	Alien
15	<i>Catharanthus roseus</i>	Madagascar periwinkle	Vinka	Herb	Plantae	Alien
16	<i>Citrus aurantium</i>	Sour orange		Tree	Plantae	Alien
17	<i>Citrus limon</i>	Bitter Orange	Mlimao	Tree	Plantae	Alien
18	<i>Cupressus lusitanica</i>	White cedar	Msanduku, Mturako,Mkrismasi	Tree	Plantae	Alien
19	<i>Dalbergia sissoo</i>	Indian rosewood		Tree	Plantae	Alien
20	<i>Eriobotrya japonica</i>	Loquat	Msambia, Kipirha	Tree	Plantae	Alien
21	<i>Eucalyptus maidenii</i> subsp. <i>Globulus</i>	Southern blue-gum	Mkaratusi	Tree	Plantae	Alien
22	<i>Eucalyptus saligna</i>	Sydney blue gum	Mkaratusi	Tree	Plantae	Alien
23	<i>Grevilea robusta</i>	Silk oak	Mwerezi, mgrevilea	Tree	Plantae	Alien
24	<i>Hevea brasiliensis</i>	Rubber tree	Mpia	Tree	Plantae	Alien
25	<i>Hovenia dulcis</i>	Oriental raisin tree		Tree	Plantae	Alien
26	<i>Hura crepitans</i>	Sandbox tree	Mbaika	Tree	Plantae	Alien
27	<i>Ipomoea cairica</i>	Morning glory		Herb	Plantae	Native
28	<i>Jacaranda mimosifolia</i>	Blue jacaranda	Mjakaranda	Tree	Plantae	Alien
29	<i>Jatropha curcas</i>	Physic nut		Shrub	Plantae	Alien
30	<i>Mangifera indica</i>	Mango	Mwembe	Tree	Plantae	Alien
31	<i>Manihot carthaginensis</i>	Ceara Rubber Tree		Herb	Plantae	Alien
32	<i>Manihot esculenta</i>	Bitter cassava	Mhogo	Herb	Plantae	Alien
33	<i>Musa paradisiaca</i>	Madake	Mgomba	Herb	Plantae	Alien
34	<i>Pinus caribaea</i>	Caribbean Pine,	Msindano	Tree	Plantae	Alien
35	<i>Pinus patula</i>	Spreading-leaved pine	Msindano	Tree	Plantae	Alien
36	<i>Pinus radiata</i>	Peruvian pepper	Msindano	Tree	Plantae	Alien
37	<i>Psidium guajava</i>	Common guava	Mpera	Shrub	Plantae	Alien
38	<i>Psidium guineense</i>	Sour guava	Mpera pori	Tree	Plantae	Alien
39	<i>Schinus molle</i>	Bronze bug		Tree	Plantae	Alien
40	<i>Senna multijuga</i>	Golden shower		Shrub	Plantae	Alien
41	<i>Senna siamea</i>	Siamese cassia	Mjoholo	Tree	Plantae	Alien
42	<i>Spathodea campanulata</i>	African tuliptree	Kifabakazi,Mfabakazi	Tree	Plantae	Native
43	<i>Syzygium aromaticum</i>	Clove		Tree	Plantae	Alien
44	<i>Syzygium jambos</i>	Champakka, Mountain Apple		Tree	Plantae	Alien
45	<i>Tectona grandis</i>	Teak	Mtiki, Msaji, Majani mapana	Tree	Plantae	Alien
46	<i>Theobroma cacao</i>	Cocoa tree		Tree	Plantae	Alien
47	<i>Toona ciliata</i>	Red cedar	Msederera-toona	Tree	Plantae	Alien

2.2 PATHWAYS FOR INVASIVE SPECIES

Pathways of introduction describe how a species is transported, intentionally or unintentionally, outside its natural geographical range (Turbelin *et al.*, 2017). Pathways also include physical means by which an invasive species is transported to a new region by humans, either deliberately or accidentally outside their natural geographical range. The arrival and entry of alien species is largely associated with human transport via one or more vectors (including ship, train, aircraft and automobile). The pathways of invasive species identified in Tanzania are grouped into six categories namely: Escape, transport-contaminant, transport-stowaway, corridors, release, and unaided. More description of each pathway category is provided in Table 3.

Table 3: Description of invasive species pathways

Pathway category		Examples
i)	Release	Species introduced as a result of biological control, conservation activities, erosion control/ dune stabilization, fishery in the wild, hunting in the wild, landscape/flora/fauna improvement, other Intentional release, release in nature for use,
ii)	Escape	Species introduced through activities in agriculture, aquaculture/ mariculture, botanical garden/zoo/aquaria, farmed animals, forestry, fur farms, horticulture, ornamental purpose, pet/aquarium species, research (in facilities),live food and live baits, later escape boundaries of introduction to other areas,
iii)	Transport Contaminant	Species introduced as contaminants in nursery material, contaminants on animals, contaminant on plants, contaminated bait, food contaminants, parasites on animals, parasites on plants, seed contaminant, timber trade, transportation of habitat material,
iv)	Transport stowaway	Species introduced due to importation/transportation of angling/ fishing aquaculture equipment, container/bulk, hitchhikers in or on plane, hitchhikers on ship/boat, machinery/equipment, organic packing material, people and their luggage, ship/boat ballast water and vehicles,
v)	Corridors	Species introduced/spread through Interconnected waterways/ basins/seas,
vi)	Unaided	Species introduced/spread through natural dispersal across borders.

Source: ISSG-IUCN

Based on literature, each of five sectors namely wildlife, livestock, agriculture, forestry and water are affected by five pathway types (i.e. escape, transport contaminant, transport stowaway, corridors and release (Figure 1). The escape category had the highest contribution on introduction of alien species in various sectors in Tanzania. The wildlife sector recorded the highest number of species escaped after introduction. The remaining sectors (health, fisheries, transport and infrastructure) are mainly affected differently by escape, transport contaminant and release. Transport contaminants and transport stowaways ranked the second in the list of recorded pathways (Figure 1). The result was similar to the analysis conducted by the IUCN analysis at global and regional levels in 2014. Invasive species which come in through corridors or unaided were relatively few but the latter is the most frequent pathway in fisheries and transport sectors.

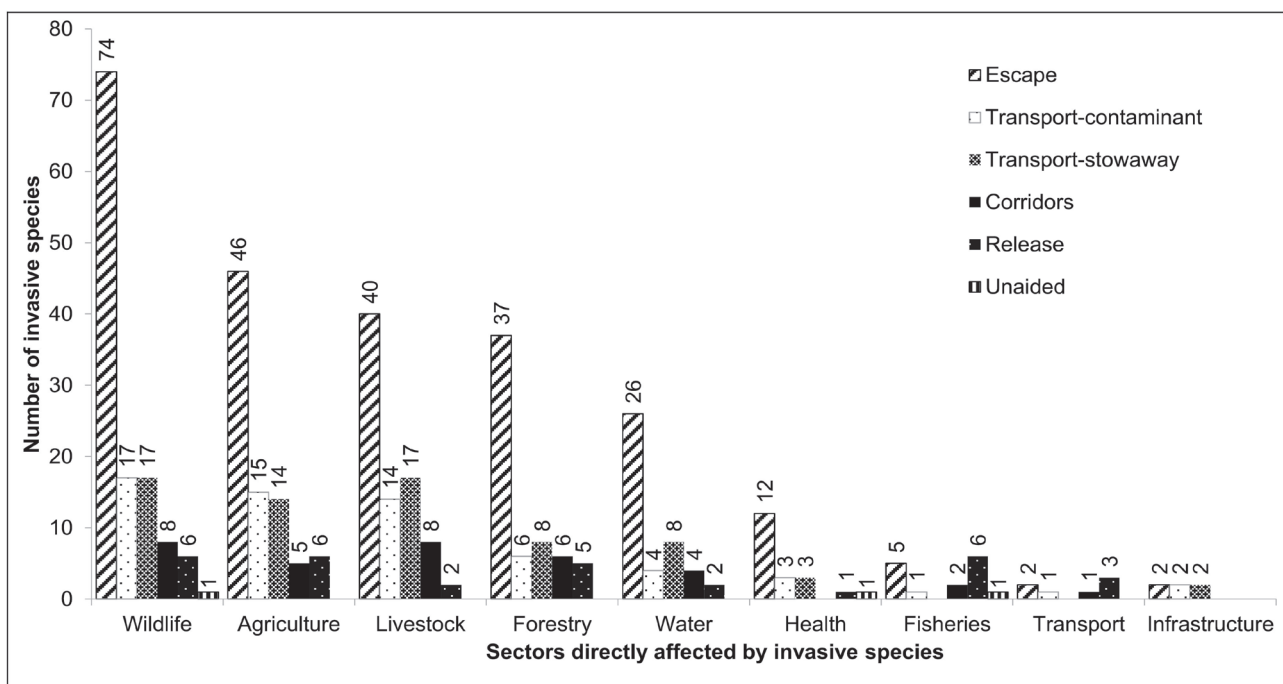


Figure 1: Pathway for introduction of selected group of invasive species to Tanzania

Although the use of information from different databases on invasive alien species to analyze pathways has helped the NTF to identify existing pathways, there is a need to prioritize the most significant means of arrival and spread of invasive species at the sectoral levels. Experiences from other countries show that analysis of pathways is a process that needs in-depth assessment of the routes by which an invasive species is transferred from one ecosystem to another. In general, nearly all pathways identified by the NTF play part in enhancing introduction and spread of IS.

Although, currently, sectoral specific pathways have not been clearly analysed, it is the opinion of the NTF that most of the sectors in the country have little or no capacity to manage these pathways effectively. The challenges related to capacity for managing this by various sectors include; limited knowledge and awareness of IS, lack of co-ordinated mechanism in communication and implementing policy and legal framework both within and across borders and sectors, lack of intra-and inter-sectoral guidelines on managing IS, lack of facilities and limited funds to enforce regulations for managing IS. Therefore, as a first step, an analysis of pathways at the sectoral level is needed, which will provide way for their proper management. Secondly, when the pathways are clearly understood at the level of sectors, they should be incorporated into an effective monitoring program that considers the process of introduction and spread of particular invasive species.

A monitoring program can be made effective by making it regularly and/or seasonally implemented depending on the nature of species under consideration and the sector itself. For example, in the livestock sector, several alien invasive species are being introduced and spread through the transfer of animals from one area to another. To manage the transfer of alien plants transferred through transfer of animals, this will need to have a monitoring program that monitors all areas involved in animals (livestock) holding bomas. Another example is that, to manage invasive species that are coming through Horticulture (gardening) will need putting an emphasis on use of alternative native species that can save the same and/or similar purpose as the alien invasive plants. Other areas that need great consideration in the process of pathways analysis include analysis of all ports of entry and the type of species that possibly get into the country borders through them including all the technicalities involved in managing such species.

2.3 THE IMPACTS OF INVASIVE SPECIES IN TANZANIA

A review of available literature revealed that not all 220 invasive and potential invasive species identified causes negative impacts to ecosystems and economic loss in the country. In spite of inadequate availability of quantifiable data, the impacts of invasive species are apparent in almost every sector. In the recognition of this, the government of the United Republic of Tanzania has initiated sectoral efforts to deal with the specific cases of invasive species in the respective affected sectors. Among this include; the on-going effort to control the invasive species in Ngorongoro Conservation area and in some Tanzanian National Parks such as Saadani National Park, Serengeti National Park and Arusha National Park.

Some of the efforts being done here include mapping of the areas affected by the invasives, mechanical removal of the invasives in the affected areas, prescribed burning as a way of suppressing invasives, and development of eco-friendly and cost-effective sustainable approaches that would realize the long-term solutions to managing this. At Ministerial level, some policies are being reviewed to further mainstreaming the management of IS in a much more effective way and the initiatives around this are recognized within the sectoral ministry of natural resources. The preliminary analysis indicates that, the Agricultural sector may be the most affected followed by Wildlife and Livestock sectors. The general sectoral impacts of invasive species have been itemized in the subsections below.

2.3.1 Agriculture Sector

The agriculture sector is the key contributor by 25.88% of the national economy (Congela, 2015). The Ministry of agriculture has reported that the problem of invasive alien species was first reported in Tanzania in 1945, and occurred in sisal plantations and later in groundnuts and bananas (Lyimo *et al.*, 2009). However, awareness on invasive species and their impacts was very low until mid-1980s to 1990s when there was much public concern about Cassava mealy bugs (1985/1990), water hyacinth (1990s), and the Large Grain Borer (LGB) - *Prostephanus truncatus*, in the 1980s that was noted for the first time in Tabora, and later spread to other parts of Tanzania.

Other IAS affecting the agricultural sector includes weed species like *Lantana camara*, *Datura stramonium* and *Argemone mexicana*. Substantial studies have also reported on the impact of *Parthenium* weed in crops in many parts of the world including Tanzania (Kilewa & Rashid, 2012; 2013). *Parthenium* weed has allelopathic chemicals with high competitive ability for soil moisture and nutrients found to inhibit germination and growth of adjacent crops such as wheat, sorghum and other plant species. The impacts of *Parthenium* are diverse, it takes only 4 weeks for *Parthenium* to develop from germination to flowering and flowering can persist for 6-8 months in favourable conditions. *Parthenium* invade and reduce land available for grazing and agriculture, suppress growth of other vegetation and cause health problems in human and livestock. Ecological impacts are such as loss of pasture for livestock and wildlife, and reduction of crop production.

The invasion and colonization of IS such as *Parthenium hysterophorus*, *Prosopis juliflora*, *Lantana camara* and *Clidemia hirta* in areas potential for agriculture reduces land for cultivation or make farming more costly (Kilewa & Rashid, 2013; Ngondya *et al.*, 2016; Kilawe *et al.*, 2017). Economically, it is estimated that in East Africa, *Parthenium* cause losses of about US\$81,9 million/annum to small scale farmers (Pratt *et al.*, 2017).

Tanzania's smallholder farmers play a major role in food security. However, infestation of croplands by invasive species reduces land potential for agriculture and food production which sometimes makes food production more costly. For example, in Kenyamonta village, about 90% the croplands have been invaded by *Chromolaena odorata*, which have caused reduced land for agricultural activities but also, lowered yield production yearly (Pers.comm.). Because of their adaptive and dominance characteristics invasive plant species (e.g. the

Chromolaena odorata) have ability to out-compete the native species and grow extensively in croplands. The *Chromolaena odorata* in the Kenyamota village have so far outcompeted the agricultural crops in most of the village land.

Sustained introductions and spread of invasions by fall armyworm (*Spodoptera frugiperda*), tomato leafminer (*Tuta absoluta*), Oriental fruit fly (*Bactrocera dorsalis*), papaya mealybug (*Paracoccus marginatus*), maize lethal necrosis disease (MLND) and Spotted stem borer (*Chilo partellus*) is threatening food security in the country. Tomato loss due to *Tuta absoluta* invasion can reach up 100%.

Largely, the impacts of invasive species in the agriculture sector have been generalized to be: reduced cash income from crop production, increased farming costs, reduced food security, increased livelihood insecurity and increased public expenditure e.g. on food relief and breeding of disease resistant varieties (Lyimo *et al.*, 2009; Kilewa & Rashid, 2012; 2013; Khan *et al.*, 2014; Ngondya *et al.*, 2016 a & b; Kilawe *et al.*, 2017).

In East Africa, it is estimated that the impacts of five major IS in mixed maize farming systems is US\$ 0.9-1.1 billion and is expected to increase significantly in the next 5-10 years (Pratt *et al.*, 2017). It has been estimated that in Africa, women spend on average 200 hours per annum weeding and about 70% of school children spend substantial amount of time helping their parents in efforts to fight IS. The FAW is however, considered to be major insect pest causing loss in maize estimated to be around US\$ 339 million in East Africa (Pratt *et al.*, 2017) and US\$3 billion in Africa (Cock *et al.*, 2017).

During field consultations, these species were reported by various consulted stakeholders. Of the most mentioned invasive species in the field were the Fall army worms (FAW) and the Tomato leafminer (*Tuta absoluta*). Some farmer stakeholders in Mwanza and Iringa indicated that they had to abandon their farms because of invasion by pests like FAW and Tomato leafminer.

In Tanzania, it is estimated that the impacts of five major IS (*Chilo partellus*, Maize Lethal Necrosis Disease (MLND), *Parthenium hysterophorus*, *Liriomyza spp.* and *Tuta absoluta*) in mixed maize farming systems to be US\$ 155.6-190 million and is expected to increase significantly in the next 5-10 years (Pratt *et al.* 2017).

2.3.2 Livestock Sector

Noxious invasive plant species have been reported to spread in most grazing lands of Tanzania. Some of the most frequently reported invasive plants in the livestock sector include: *Astripomoea hyoscyamoides* known as Kongwa weed and locally known as Mahata. The *Astripomoea hyoscyamoides* is known to spread in Kongwa and other parts of central Tanzania. Other noxious plants include: *Chromolaena odorata* commonly known as Siam weed and locally known as Amachabongo which spread in Serengeti and other parts of Lake zone; *Gutenbergia cordifolia* and *Eleusine jaegeri*, spread in Ngorongoro Conservation Authority (NCAA) and other neighboring areas which are overgrazed areas (Ngondya *et al.*, 2016); *Prosopis juliflora* locally known as Mrashia, which is spreading in Rombo, Moshi, and Mwanga districts and some other parts of North-Eastern Tanzania and *Lantana camara*, which is spreading in many overgrazed semi-arid areas.

In north-western Tanzania (Tarime-Serengeti Districts) farmers and livestock keepers have complained that Siam weed (Amachabongo) is killing palatable species and other pastures and in addition is causing eye blindness and other menace to livestock. Farmers are seeking solution using indigenous technical knowledge (ITK) and are seeking scientific help as it is threatening their livestock existence and hence their livelihoods (DLOs Serengeti Districts reports; Antony Mayunga - Mwananchi Newspaper -July 15, 2014; Mtambuki *et al.*, 2013; Mwilawa *et al.*, 2013; Anderson, 2005). Forage production has been adversely affected by

the spread of this weed, making the already existing problem of forage scarcity in the area more serious, especially during the dry season.

Earlier work from other countries have reported that the Siam weeds have negative effects to livestock and wildlife on reducing available pastures and associated plants on grazing lands, negative effects on livestock and others have argued the possibility of using it as feed (Koutika and Rainey, 2010; Dumalisile, 2008). It induces allelochemicals to the soil, reduces grazing potential, and increases the intensity and frequency of fires in natural forested areas. Mwilawa *et al.*, (2015) have reported that, invasion of *Chromolaena* in Serengeti district reduces pasture which ultimately affects forage availability and crop growth for ruminant animals. The invasion have reduced the forage available for livestock from a total forage yield of 2,750 kgDM/ha to 1,150 kg DM/ha in areas with Amachabongo at Kenyamonta ward, Serengeti District hence affecting the potential grazing capacity. The most invaded areas with Amachabongo (in areas used to be grazing site) greatly lowered the livestock carrying capacity to about 15 TLU (ha/LU/yr) at Kenyamonta ward, Serengeti District. Other areas with moderate infestation the livestock carrying capacity is 6 TLU (ha/LU/yr). The commonly average livestock carrying capacity in semi-arid was reported to be 3 TLU (ha/LU/yr). It is noted that continuous grazing in such areas reduces the TLU due to forage loss. The Amachabongo invasion causes deficit of forage and enhances bush encroachment. It equally implies that in order to meeting forage supply needed to animal demand, large piece of land is highly needed. This situation usually results to risk of overgrazing, encourages livestock movement in search of pasture which has ultimate danger to conflict with other users of land. Moreover, the invasion of *Chromolaena odorata* locally decrease the abundance of native species such as *Themeda triandra* and *Hyperphenia* sp. Siam weed is also included in the World's worst tropical weeds due to its ability to invade and out-compete native vegetation thus reducing grazing potential for wildlife and livestock through allelopathy.

Astripomoea hyoscyamoides is highly competitive, and has become one of the noxious weed dominating cropland and rangelands, particularly in the district of Kongwa in central Tanzania. The species is recently spreading towards Eastern, Central and northern parts of Tanzania (Nkombe *et al.*, 2018). In its infested areas, the species is outcompeting native species for nutrients, light and space. The invasion of *Astripomoea hyscamoiedes* (Kongwa weed) on grazing lands for Livestock and wildlife inhibits the forage growth and decreases the carrying capacity of the land, and in cropping lands it increases weeding costs (Nkombe *et al.*, 2018).

Discussions with Authorities at TALIRI in Kongwa indicate that the invasion by Kongwa weed (*Astripomoea hyoscyamoides*) in established Buffel grass (*Cenchrus ciliaris*) stand has significant loss in the farm. The estimated costs showed that if paddocks were invaded at least by 15 percent then the numbers of animals to be kept in the paddocks were reduced from 260 cattle to 225 growing Boran cattle with average of 250 kg live weight (Table 4). Similarly, the farm conserve forage in terms of hay bales which is usually sold to smallholder dairy farmers and urban smallholder dairy keepers. It was estimated that if the same paddocks the forage was conserved for hay bales the total amount of money that could have lost due to Kongwa weed invasion was about Tshs 25.1 million annually with input costs of Tshs 14.5 million (Table 5).

Table 4: Estimated reduction in number of cattle to be supported due to invasion of Kongwa weed (*Astropomoea hyscamoedes*) in paddocks with established stand of Buffel grass (*Cenchrus ciliaris*) at TALIRI Kongwa, during 2017/2018

Parameter	Buffel grass Production kg DM/100 ha/year ¹	Potential forage graze ² (kg DM/ha/yr)	No of cattle to graze / year
No Invasion	1,220,000	732,000	260
With Invasion (15%)	1,037,000	622,200	225

¹ Prodn 1ha Buffel grass $\equiv$ 12,200 kg DM/ha/yr (Mero *et al.*, 1995); 1 yr $\equiv$ 365 dys;

² 1 TLU (cattle -growing Boran) $\equiv$ consumes 7.5 kgDM/d; Consumption

Table 5: Estimated amount of money received from Hay bales made from paddocks with established stand of Buffel grass (*Cenchrus ciliaris*) at the farm without and with invasion of Kongwa weed (*Astropomoea hyscamoedes*) at TALIRI Kongwa, during 2017/2018

Parameter	Buffel grass Production kg fresh/100 ha/year ¹	Potential forage hay bales (kg DM/ha/yr)	Amount (Tshs '000)
No Invasion	1,326,000	88,400	265,200
With Invasion (15%)	199,000	13,200	39,600

¹ Prodn 1ha Buffel grass $\equiv$ 13,260 kg DM/ha/yr; 1 Bale of hay $\equiv$ 15 kg; Price Tshs 3000/= per Bale

Other invasive species is *Prosopis juliflora* tree which have invaded in Rombo and Mwanza districts spreading from the bordering town of Taveta Kenya (Mtambuki *et al.*, 2013; Mwilawa *et al.*, 2013). During the field visit it was indicated that, the *P. Juliflora* has so far spread in parts of Holili and is spreading to Mwanza, Rural Moshi and other parts of Same Districts. Farmers have reported that the shrub forms impenetrable thickets that are preventing other plants from growing. Also goats get bad teeth after eating the sugary pods from trees, which leads to teeth loss and thus starving goats. Also, thorns of *P. juliflora* may cause injuries on people and livestock. Similar observations were reported in Kenya (Lenachuru, 2003; Andersson, 2005). The documentation of the *P. juliflora* spread and its negative effects has been more intensively conducted in Kenya and in IUCN's list of invasive alien species (Mwangi and Swallow, 2005). Due to its known threats it is extremely important that investigation be done to prevent /control it from spreading wider in Tanzania. Owing to the difficulties in eradicating the *Prosopis* species, experiences from elsewhere that could be employed to control the invasions may be considered for implementation in Tanzania.

Caesalpinia decapitala is an aggressive exotic plant that invades grazing land, riparian vegetation, forest margins and savannas, which forms impenetrable, prickly thickets, injures animals and humans, causes trees to collapse, uses excessive amounts of water and increases fire risk. The dense leaf canopy overshadows other plants and ousts the natural vegetation. In plantations, the species seriously hampers activities.

Parthenium is another invasive plant that affect livestock sector. It has been shown that in rangelands, Parthenium can reduce pasture production by 90%, threatening pastoral livelihoods. Loss of pasture to livestock may also increase livestock movements and therefore conflicts with other rangelands users particularly the farming communities.

2.3.3 Fisheries Sector

It is important to recognize that, the aquatic systems harbor the largest diversity as compared to the terrestrial environment although the latter stands to be the most studied. Furthermore, the fisheries sector has equally high contribution to the National GDP. For example, in 2014 the fishery sector including aquaculture contributed 2.4% to gross domestic product, and has been growing at the rate of 5.5 per cent (Economic Survey Report, 2014; Benard *et al.*, 2018). Despite its importance, the sector has been highly affected by IS. Most reported of the IS in the fisheries sector is the Nile Perch that has been reported to deplete more than 350 fish species in Lake Victoria.

Introduction of *Oreochromis nilotica*, *O. zillii* and *O. Leucostictus* reduced native tilapiines particularly *O. variabilis* and *O. esculentus* through competition for habitat (Ogutu-Ohwayo & Hecky, 1991) and hybridization (Kudhongania & Chitamwebwa, 1995; Ogutu-Ohwayo and Hecky, 1991). Some of the species that have been heavily impacted in Lake Victoria include: *Oreochromis esculentus* and *O. variabilis* (Lyimo *et al.*, 2009). The Nile perch was introduced in the lake in the 1950's as a management measure, to utilize Haplochromines which were in abundance, commercially unimportant and almost regarded as "trash fish" (Witte *et al.*, 1992). With time, Nile Perch has become invasive although also regarded as economically important thus creating a potential conflict of interest when it comes to its management (Table 6).

Water hyacinth (*Eichhornia crassipes*) is one of the invasive aquatic weed affecting the environment and the overall fisheries in the Lake Victoria as well as other lakes in Tanzania. Both the introduction of Nile perch and the invasion by water hyacinth in the lake have had impacts on the lake biodiversity and on the local community livelihoods, especially those whose main livelihood activity is fishing. Furthermore, spread of Water hyacinth in Lakes Victoria, Jipe and *Prosopis juliflora* in Nyumba ya Mungu have blocked access to water resources and fisheries and jeopardize the livelihoods of thousands of fishermen. Another not very commonly reported water invasive species that is quite dangerous is the species known as *Trapa natans*. The species is said to have very dangerous spines that once they prick human body, the wound can persist for period of more than three months (Pers comm). During site visitation in the lake zone, a number of species were reported with indicative impacts thereof. The list has been summarized on Table 6 below.

Table 6: Summary of reported water invasive species in Lake Victoria Zone

S/N	Species	Impact	Area/Scale of the Problem	Management Strategies and community involvement
1	Nile tilapia (<i>Oreochromis niloticus</i>)	Has significantly boosted the fisheries industry in the Lake Victoria.	-Across Lake Victoria and satellite lakes in the region. -Also found in other great lakes in Tanzania	None
2	Nile perch (<i>Lates niloticus</i>)	Has significantly boosted the fisheries industry in the Lake Victoria. Known to cause decline to extremely low levels or vanished of more than 350 indigenous fish from the Lake Victoria. Lead to imbalances of components of trophic levels.	Across Lake Victoria	None

S/N	Species	Impact	Area/Scale of the Problem	Management Strategies and community involvement
3	<i>Trapa natans</i>	Very sharp thorns which pierce people and wounds take > 3 month to heal. The weed displaces native and severely impede recreational activities, fishing from the shoreline, watering animals	Reported in the Lake Victoria Tanzania in 2001 in Biharamulo District. In July 2003 the weed had already spread to Geita, Misungwi and Bukoba rural.	Manual removal Trials so far seem expensive.
4	Water Hyacinth	Water bodies (Lakes and dams). Affect mobility/ water navigation/ transportation and fish production sites. Harbor dangerous animals like Crocodile and snakes.	Bukoba municipal, Bukoba rural, Misenyi, Karagwe, Chato, Sengerema, Misungwi, Magu, Ilemela, Nyamagana, Musoma urban, Musoma rural, Rorya, Bunda.	Integrated Pest Management (IPM) strategies by applying bio control. Manual/physical removal).
5	<i>Azolla filiculoides</i>	Prevent light from penetrating hence create anaerobic conditions detrimental to aquatic organisms. Reduce water quality and increase siltation. Water invaded with <i>Azolla</i> is very unpalatable to people and animals.	Water bodies (lakes, dams and slow moving water around Lake Victoria). Although not yet estimated, but spread very fast in the regions.	Controlled manually by raking in the water bodies.

Water hyacinth proliferation is dependent on nutrient availability, a condition offered by the eutrophic Lake Victoria. In the 1980's the percentage cover of the weed in the lake was relatively low compared to the 1990's when it reached a maximum in 1998. At the inception of LVEMP activities for controlling water hyacinth in 1997, the weed covered 700 ha. It extended to over 2,000 ha of the Tanzanian part of the Lake covering over 75% in some sheltered bays and gulfs, threatening the livelihood of many households in the Lake Victoria Basin (LVEMP, 1999).

Despite the negative economic impacts on the economies of the riparian communities, quantification of economic losses is not established. Efforts to reduce the rate of infestation have been made at national and local levels. At national level, through the Lake Victoria Environmental Programme (LVEMP) the weed was successfully brought under control using biological, mechanical and manual methods. The total cost of LVEMP was about USD 8.3 million for the three countries (Kenya, Tanzania and Uganda).

Different fish species responded differently to the effects of water hyacinth. A study in Lake Victoria – Kenya showed that catches of some indigenous fish species increased with water hyacinth cover (Njiru *et al.*, 2004). This pattern is unexpected calling for a similar but more thorough study in the Tanzania part of the lake and other waterbodies affected by water hyacinth.

The invasion of water hyacinth dramatically affects water flow, blocks sunlight from reaching

native aquatic plants which often die. During its decay processes it depletes dissolved oxygen in the water, often killing fish. The plants also create a prime habitat for mosquitos, the classic vectors of malaria and other diseases, and a species of snail known to host a parasitic flatworm which causes schistosomiasis (snail fever). Water Hyacinth in Lake Victoria covering approximately 518 ha, has changed fish habitat through deoxygenating of water and reduction of nutrients in sheltered bays, which are breeding and nursery grounds (NBSAP, 2014). In Lake Victoria, about 350 species of haplochromines have been predated to disappearance by Nile perch (*Lates niloticus*) (LVEMP, 2005; Shechonge, 2017). About US\$8.3 million were used to control Water Hyacinth in Lake Victoria (LVEMP, 1999).

Translocation of fish species between waterbodies within the country has caused disaster to some native fish species. For example, *Oreochromis hunter*, endemic to Lake Chala, was once abundant but has been pulled down to insignificant numbers following introduction of other three species into the lake from other waterbodies in the upper Pangani drainage (Moser *et al.*, 2018). However, some of IS have positive impacts to the economy if well managed. Nile Tilapia has been used as the major source of nutrients and income in the lake zones and beyond. Presence of the species can thus strengthen or create new economic opportunities (employment and income). Despite large potential for utilization of some IS already in Tanzania, these opportunities have not been well explored.

With the fast-growing aquaculture subsector, the country is facing new challenges related to introduction of exotic species or even translocation species between water basins and associated waterbodies. This requires strict monitoring and regulation of fish seed movement. One of the suitable strategies to prevent invasion and unwanted translocation the government should put in place regulatory mechanisms to restrict importation of fish seed while promoting farming of local fish species. Establishment of hatchery facilities within water basins will add the efforts against further invasion and the consequent effects on local biodiversity.

2.3.4 Forestry Sector

In the forestry sector there are various invasive species that have been reported to cause impacts on the environment. These include the *Cedrela odorata* in Kimboza Forest Reserve, *Acacia mearnsii* in Chome Nature Reserve and *Maesopsis eminii* in Amani Nature Forest Reserve. The *Cedrela odorata* was introduced in more than 40 years ago (Hagen *et al.*, 2006) and so far has been reported to have colonized a large part of the forest, suppressing the native species and almost replacing the indigenous tree species (Figure 2). The existence of these species is therefore threatening the existence of native species in country's top biodiversity hotpots. Important to note is that, the IS does modify the soil conditions in such a way that no successful regeneration of primary tree species may occur. Most reported impacts of the forest sector are also interconnected to those in the agriculture and the rangeland in general.

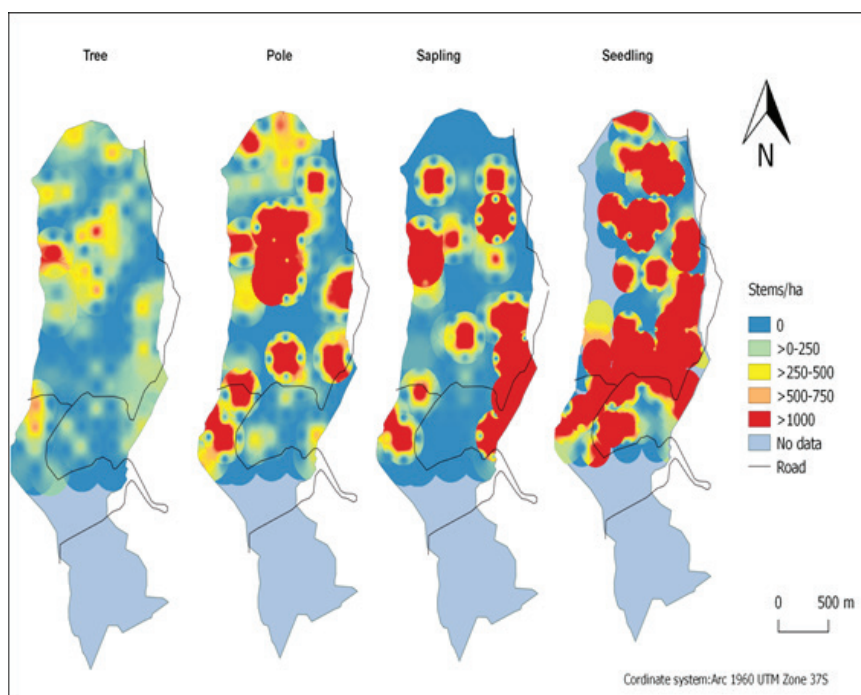


Figure 2: *Cedrela odorata* invading and replacing native species in Kimboza Forest Reserve. Source: Kilawe, (2017, unpublished report)

Biological invasion by *Cedrela odorata* in Kimboza Forest Reserve has colonised larger parts of the forest and replaced native species (Figure 2). Invasion of *Prosopis juliflora* in Kenya, Ethiopia and Tanzania has been associated with increased mortality of native *Acacia erioloba*. Replacement of indigenous plants by IS has serious repercussion on other organisms (Shackleton *et al.*, 2015). For example invasion by *Acacia insulae-iacobi* significantly reduced abundance and diversity of birds in Mpwapwa District (Figure 3). Similar effects have been reported for *Cedrela odorata* on the population of critically endangered lizard in Kimboza Forest Reserve (Fleck *et al.*, 2012), and *Azadirachta indica* on diversity and abundance of small mammals in Saadani National Park (Silayo and Kiwango, 2010).

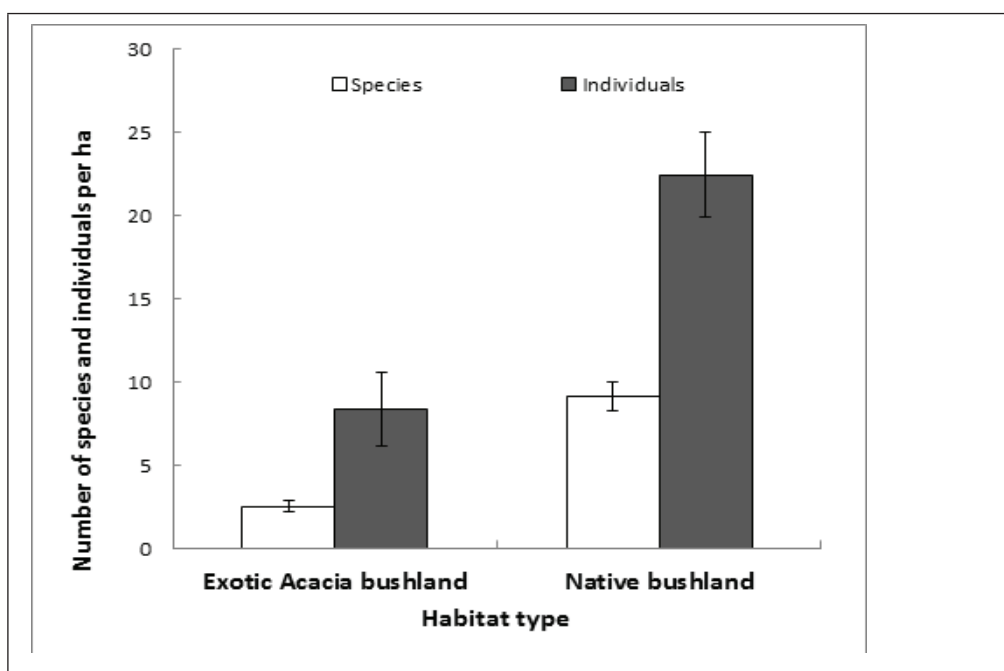


Figure 3: Invasive *Acacia insulae-iacobi* affecting abundance and diversity of birds in Mpwapwa (Source: Werema, 2017)

Acacia mearnsii commonly known as Black Wattle is estimated to occupy about 210 condensed hectares of Chome Nature Reserve in Same District (condensed area means area covered when the plant is assumed to occupy 100% of the area). This area is equivalent to 1.5% of the total area of Chome Nature Reserve. In this case 210 hectares of native vegetation has completely been displaced by the plant *A. mearnsii*. The cost of clearing *A. mearnsii* and allow for regeneration of native species was estimated to be TZS 164.7 million. This is done by clearing the invasive species and two follow ups by removing the regenerating seedlings of *A. mearnsii* which come after rain seasons. The cost has not included enrichment planting by native vegetation or tree species, although in some areas of the reserve, enrichment planting is inevitable to hasten regeneration.

Prosopis juliflora (Mrashia, Mgunga taveta in Kiswahili language) is considered a serious threat in grazing and agricultural lands in Rural Moshi, Mwanga, Simanjiro, Mkinga, Same, Monduli and Kilindi Districts (Kilawe *et al.*, 2017). In 2018, the Woody Weeds project (www.woodyweeds.org) estimated the cost to control *P. juliflora* in agricultural areas around Kahe - Moshi Rural. It was established that it costs TZS 2,135,000/= to clear one hectare invaded with *P. juliflora* in order to prepare it for agriculture. The tree species has been observed in Mvomero Morogoro nearby Miombo and Acacia woodlands. There is big risk that the species could be introduced to nearby Miombo forests due to movement of livestock.

Control of *Prosopis* involves physical methods by cutting and uprooting stumps, whereby roots must be removed at least 15 cm below the ground. Chemical methods involves: application of herbicides on cut stumps and the bark of the stem up to 75 cm (basal bark). The preferred chemical is Triclopyr. Biological method uses a leaf tying moth of the genus *Evippe* that has been tried in Australia and South Africa and found effective. Awareness creation is being done to ensure that the species is destroyed once observed in nearby reserved forests

Some IS however, have positive impacts to the economy if well managed. For example *Prosopis juliflora* and *Cedrela odorata* produce wood that can be used for timber, poles and charcoal; *Leucaena leucocephala* is widely used to enrich soil fertility, and provide supplementary fodder for livestock, living fences and timber.

2.3.5 Wildlife Sector

Analyses have indicated that, there is quite high number of potential and invasive species in the protected areas (i.e National Parks, NCA, Forest and Nature Reserves). According to various consultations and the compiled data, it appears that most of the protected areas are infested by invasive and potential invasive species thus threatening the sustainability of tourism and forest industry in the country. In total, 116 species (both invasive and potentially invasive) have been documented in these sensitive areas which are the main source of income in the tourism sector (Appendix 8). The number of IS identified in the areas differ between them although some have similar species.

The available data have further indicated that, so far the NCA have the highest number of invasive species (38), followed by the Serengeti National Park (30) while Amani Nature Reserve had the lowest number (i.e. 29 species). Among the potential invasive species that may cause serious impact include *Parthenium hysterophorus* which produces allelochemicals which inhibit germination and growth of adjacent native species. Similar effects have been observed for *Chromolaena odorata* (Siam weed) on abundance of *Themeda triandra* and *Hyperrhenia sp.* These species are well known as serious threats and are included in the top 100 worst global invasive species list. It has been estimated that *Parthenium* causes losses of about US\$81.9 million/annum to small scale farmers (Pratt *et al.*, 2017).

The Indian house crow is detrimental to indigenous bird species through predation or

competitive displacement by attacking, mobbing birds and destroying eggs as well as nests (Chongomwa, 2011). Crow predation on reptiles and amphibians, taking eggs and chicks of free-range poultry, attacking new-born kids and calves (West, 2010; Fraser *et al*, 2015).

Currently, plant IS have been observed to result into changed hydrological patterns hence leads to displacement of wildlife. Due to their ability to change soil characteristics such as pH, IS leads to disappearance of some delicate and palatable species, and replacement with resistant, less palatable species to wildlife. This also leads to wild animals' displacement. Some IS have poisonous characteristics which cause death when consumed in large amounts by wildlife. In the Ngorongoro conservation area, invasive species have been reported to cause negative impacts on wildlife by reducing forage and biodiversity. They invade relatively large grazing area replacing the native species with unpalatable or non-edible species while reducing potential land for forage production. According to Ngondya *et al.*, (2016) the spread of IS in wildlife protected areas may lead to overgrazing in some areas and may force wildlife out of protected areas and hence causing increased human-wildlife conflicts and potential poaching. *Gutenbergia cordifolia*, *Biden schemperi*, and *Tagetes minutes* have for instance invaded the Ngorongoro crater floor covering almost half of its size i.e. 250 km². This invasion has significantly reduced grazing area for herbivore and in turn redistributes the local wildlife to other areas in search for forage.

A more recent detailed ground surveys conducted by TAWIRI in the NCA crater area in 2018 show that, of the total crater area (~260 km² or 26000 ha), 27.113 ha are covered by invasive species (squeezing all invasive species together). *Gutenmbergia cordifolia* covers 18.246 ha equivalent to 67.30 % of the total area infested by invasive species in the crater. The remaining infested area is occupied by other invasive species including Baggartics (*Bidens schimperi*) which covers 4.14 ha or 15.28 % of the total infested area, Marigold (*Tagetes minuta*) covers 2.656ha or 9.80% of infested area and Thorn apple (*Solanum incanum*) covers 1.984 ha or 1% of infested crater area. These species have occupied areas which were previously used by wildlife for foraging. The replacement of these area with invasive species have caused changes in animal movements within the crater, a fact which is supported by the recently published research finding by Ogutu *et al.* (2019), which showed that wildlife abundance continue to decline in the crater area. Other research work have shown that the vegetation structure in the Ngorongoro crater changed from being predominately short grassland in 1967 to mid and tall grasses dominating in 1995 (Ogutu *et al.* 2019). This is due to the fact that most of the invading species are herbs which are relatively tall than the indigenous grass species.

In the Serengeti ecosystem, a study conducted by TAWIRI in 2012 show that the area occupancy of invasive plant species *Opuntia* sp estimated to a total of 5.16 ha out of the total 45.2 ha surveyed. Further expansion of the same species continues to new areas as per recent observations. In Saadani National Park the rapid invasion of grassland patches by *Acacia zanzibarica* threat the existence of grazers in the park. For example, during field visits in the Saadani National Park it was noted that, some areas were overgrown into thickets which eventually destructed wildlife visibility and blocked penetrability as they move in searching for food or when hunting. Similar effect by *Caesalpinia decapetala* and *Acacia zanzibarica* is reported in Arusha National Park and Selous Game Reserve (Selous Matambwe block Z1), respectively.

Therefore, altering grazing opportunities for wildlife forces wild animals to squeeze into the remaining habitable area, or move outside protected areas. Long term data (Veldhuis *et al.*, 2019), suggest that squeezing wildlife into the core of Serengeti National Park is damaging habitation and disrupting the migration routes of wildebeest, zebra and gazelle. This has happened in areas around other protected areas in the country whereby when wildlife is displaced from their natural areas, they sometimes move into community land, where they can find water and pasture. This leads to human-wildlife conflicts as well as escalated poaching incidences. In areas where there are rare and endangered species,

such as Chimpanzees in Mahale and Gombe National Parks, displacement of wildlife can have dire impacts whereby the chimpanzees move into communal land, where they increase the probability of contacting infectious zoonotic diseases, which can decimate their population or endanger human life. In addition, IS on water surface prevent the infiltration of sun rays leading into drop of oxygen levels, which have a direct impact on the abundance and diversity of aquatic organisms. Effects of IS could potentially make ecosystems less resilient to future shocks such as drought or further climate change. Directly and indirectly, tourism is finally negatively affected by loss of revenue to the nation.

Economically, invasive species continue to cause serious monetary loss through the wildlife sector. Although there is scant literature regarding impacts of IS to the tourism/wildlife sector, TANAPA and NCAA are spending quite a large sum of money in managing the IS. According to discussions with NCAA and TANAPA representatives it appears that, quite large amount of money has so far been spent in the managing the invasive species in these areas. For example, the NCAA reported that they had set aside about 500 million for invasive species management in the NCA while TANAPA had allocated TZS 567,600,000/- only for the 2018/19 fiscal year. Cumulatively, TANAPA said that they had spent 1.5 billion TZS during the last ten years to manage invasive vegetation in their areas. Therefore, for the past 11 years, TANAPA has spent about 2 billion TZS on invasive species problem in the Tanzanian parks indicating the magnitude of the problem.

2.3.6 Tourism Sector

Chromolaena odorata, *Gutenbergia cordifolia* and *Parthenium hysterophorus* are among the species that are replacing natural vegetation preferred by wildlife in Ngorongoro and Serengeti at an alarming rate (c.f. Mwilawa *et al.*, 2015; Ngondya *et al.*, 2017). The over dominance of *Gutenbergia cordifolia* in more than half of the Ngorongoro crater (Ngondya *et al.*, 2016) has led to poor distribution of animals and reduced land for forage production thus causing serious threat to sustainability of forage production in both the livestock and wild animal areas of Tanzania. This is seriously threatening tourism sector which is one of the biggest foreign currency earners for Tanzania. So far, IS impact to the tourism sector has not been well documented.

2.3.7 Health Sector

As other sectors, the health sector is among affected sectors by IS. Although largely unconfirmed, some of IS has been reported to cause health problems to human and animals. *Parthenium hysterophorus* for example causes allergenic rhinitis, asthma, bronchitis, dermatitis, and hay fever to humans (Gnavel, 2013). Similarly *Cedrela odorata* pollens and sawdust has been reported to cause asthma and allergies where tree is planted and timber sawn near settlements (Mashauri, 2017). *Prosopis juliflora* and *Trapa natans* thorns cause serious injuries to human and animals-sometimes leading to disabilities.

Table 7: Summary of control mechanisms applied in some selected IS in Tanzania

S/N	Name/Scope of invasive species targeted to control	Impacts	Control options	Comments on performance (Technology Effectiveness)
1	Fall army worm (<i>Spodoptera frugiperda</i>)	Reduce cereal crop yields up to 100% if unchecked. In 2017/18 it was initially reported to the MOA 71,426 hectares were affected.	Intercropping of maize varieties with push and pull technology Chemical control	Effective by more than 80% if timely and appropriately applied. Example, Moshi has been successful by more than 80% due to adoption of the Fall armyworm symptomatic spraying scheme for Tanzania (FSST) techniques which is timely control with appropriate pesticide, taking consideration type of damage.
2	<i>Prosopis juliflora</i>	Reduce land available for grazing and agriculture Block access to water resources and fishing Cause health problems in human and livestock Lead to conflicts between farmers and pastoralist	Mechanical control-cut before flowering and uprooting Chemical control –basal bark	60% but very expensive Very effective (90-100%) but it is expensive and requires technical know how
3	<i>Parthenium hysterophorus</i>	Reduce land available for grazing and agriculture Suppress growth of other vegetation Cause health problems in human and livestock	Mechanical: Uproot and burn Chemical: Foliar spray (Herbicides) Bio-control: Beetles (<i>Zygogramma bicolorata</i>)	Effective if done before flowering or continuous uprooting of new regenerates On trial by TPRI in Arusha, but found to be effective in other country's trial.
4	<i>Atripomea hyscamoides</i> (Kongwa weed)	Reduce land available for grazing and agriculture Suppress growth of other vegetation	Mechanical: Cutting before flowering Mowing frequently when still young (2-3) times	Effective if conducted before flowering and/or continuous uprooting of new regenerates

S/N	Name/Scope of invasive species targeted to control	Impacts	Control options	Comments on performance (Technology Effectiveness)
5	<i>Chromolaena odorata</i>	Reduce land available for grazing and agriculture Lead to conflicts between farmers and pastoralist, and pastoral versus pastorals Suppress growth of other vegetation Reduce availability of thatching grass Cause eye abrasions and itchy and can lead to blindness	Mechanical: Frequent uprooting and burn	Effective if conducted before flowering and/or continuous uprooting of new regenerates
6	<i>Guttenbergia cordifolia</i> (Guttenbergia)	Reduce land available for grazing and agriculture Suppress growth of other vegetation Affect distribution of animals	Mechanical: Frequent mowing /slash /uprooting before flowering Nature based approach (plant-plant competition)	Effective if done before flowering and/or continuous uprooting/mowing/slaughtering of new regenerates Preliminary assessment 50%
7	<i>Eleusine jaegeri</i> (Eleusine)	Reduce land available for grazing Suppress growth of other vegetation Affect distribution of animals Impair animal visibility and movement	Mechanical : Uproot and burn	Effective if done before flowering continuous uprooting of new regenerates Expensive to undertake
8	<i>Caesalpinia decapetala</i> (Mauritius thorn)	Reduce grazing and ranging land Impair animal visibility and movement	Mechanical: Cut, uproot and burn	Very effective but expensive

S/N	Name/Scope of invasive species targeted to control	Impacts	Control options	Comments on performance (Technology Effectiveness)
9	<i>Eichhornia crassipes</i> (<i>Water hyacinth</i>)	Cut off oxygen supply to aquatic organisms Block access to water resources, beach and fishing Destroy fish breeding to aquatic organism Provide good breeding site for disease spreading vectors – Malaria, Bilharzia, etc Interferes with irrigation and water supply Increase water treatment costs	Mechanical: Uproot, burn and trawling Biological : Weavers (<i>Neochetina eichihonea</i>) and nites Integrated pest management (IPM): (Biological and chemical)	Very effective but labor intensive About 90% Effective
10	<i>Tuta absoluta</i> (Tomato leaf miner)	Tomato yield loss of up to 100% if unchecked.	Integrated pest management (IPM) Exclusive netting (screen house of 0.4 x 0.7 mm), Crop rotation, use of clean seedlings, Chemical: (spinetoram, Spinosad, imidacloprid, emamectin benzoate, abamectin, Flubendiamide 480g/L, and Chlorantraniliprole 200 g/L, Bio-pesticides: <i>Manisophea</i> Use of the Double door bucket movement (DDM) mass trapping technology	80-95% 100% Effective

2.4 APPROACHES FOR MANAGING INVASIVE SPECIES IN TANZANIA

Sector specific management practices for managing invasive species in Tanzania exists. Various approaches ranging from sector specific to institutional initiatives have been used in managing IS in Tanzania (Table 7) . At each level the approach has been to address a specific IS at a specific location. Some of management practices of existing IS in each sector is presented below.

2.4.1 Agriculture Sector

The Plant Protection Act (PPA) No. 13 of 1997 focuses on prevention of introduction of exotic pests and their spread to manage outbreak pests (URT, 1997). Through the PPA, the Ministry of Agriculture maintains the regulatory control of imported plants and plant materials through crop inspections at all points of entry i.e. harbours and ports, border outstations and airports. All plant and plant products imported and exported from Tanzania are also subjected to inspection for pests at all border points around the country (Lyimo et al., 2009). According to Article No. 9 (2), the scientific materials may be permitted if there are satisfying evidences that the importation will not present significant threat to the agriculture or natural environment of Tanzania (PPAAct, 1997). This shows that the Act is strict in plant importations to safeguard the country from biological invasions.

The control of Fall armyworm can be achieved using cultural method that involve intercropping of maize with other less susceptible crops like pigeon peas, cassava, pumpkins etc. The less susceptible crops may interrupt egg laying and increase diversity of natural enemies that attack fall armyworm. Also “push and pull technology” is used whereby Desmodium plant is intercropped with Maize and Napier grass or Brachiaria plants. Desmodium is repellent plant to Fall armyworm, and Napier grass or Brachiaria plants that will be planted surrounding maize field is attracting or pulling plant, therefore fall armyworm will attack Napier or Brachiaria and leave the maize. Also the use of botanical pesticides such as neem extracts, the use of ashes, etc. Chemical control using various recommended pesticides including chemicals with active ingredients of Emamectin benzoate, Lamdacyhalothrin, Profenofos, Deltamethrin, Chlorpyrifos, etc. and Biological control involves use of *Bacillus thuringiensis* to reduce high abundance of FAW larvae and use of natural enemies or beneficial organism found in our environment including pathogens (disease causing organism) and predators (attacking organism).

In the event of knowledge and awareness of the outbreaks, it is possible to control and contain invasive species such as FAW. The good example on this was shown by the Kilimanjaro Regional Authorities during the outbreak of FAW in the last cropping season (Rain season of 2018). The Regional Administrative Secretary informed the NTF that, rapid response by the regional authorities through assistance from Ministry of agriculture, and using district extension systems, knowledge dissemination through awareness creation and use of appropriate pesticides was a secret for success in containing and controlling FAW outbreak in the region. This led to little losses of crop yield by farmers during the season.

Parthenium is controlled by physical method which includes pulling to uproot before flowering as well as burning. It can also be controlled by Chemical methods through foliar spray using 2, 4-D; Picloram + 2, 4-D amine; Glyphosate + metsulfuron; Paraquat + diquat. Biological control involved use of leaf eating beetle called *Zygogramma bicolorata*. Control efforts in Tanzania started about three years back. Biological control trial using *Zigogramma* currently being coordinated by TPRI.

Tuta absoluta can be controlled through integrated pest management (IPM) using chemicals like Spinosad and Imidacloprid. Biological control is done by using *Bacillus thuringiensis* and mass trapping methods.

2.4.2 Livestock Sector

The Grazing-land and Animal Feed Resources Act, 2010 section on item on grazing land development 18.-(1) Any development on the grazing-land, shall be undertaken in a manner that is consistent with sustainable land use planning and management practices. (2) The grazing-land development shall include but not limited to (a) vegetation management practices directly concerned with the use and growth of plants; (b) livestock management and marketing infrastructure; and (c) environmental conservation and development of water sources for livestock use. Furthermore, the Act restricts on the manufacture, importation or sale of animal feed resources. It is described in section 21.-(1) that, a person shall not manufacture, export from or import into Mainland Tanzania any animal feed resources unless he has obtained a permit issued by the competent authority. (2) A person shall not manufacture, sell, export or import into Mainland Tanzania any animal feed resources that may adversely affect animal, human health and the environment or which contain substances listed under the Second Schedule to this Act.

The Animal Diseases Act, 2003, also have stipulated in section 17 (13) that no person shall move animals, animal products and waste into or from the buffer area without a written permission of the inspector where part III 54 (1) has restricted that no person may bring or cause or permit or allow to be brought into the country any diseased animal, disease animal product except in accordance with prior authority of the Director or certificate issued by the Director. The Act also restricts movement of animals in that no person shall (a) move an animal on foot or by use of a vehicle outside the Inspectors' area of jurisdiction without a permit, or (b) move an animal or animal products or animal wastes from outside of the country or introduce animals into any area without a permit.

The control of *C. odorata* includes; mechanical control which involves frequent uprooting and burn. Chemical control : this involves application of herbicide in two ways, one method is foliar application which is application of herbicide on leaves, and second is basal bark application which is the application of herbicide on stem's outer layer on lower part (base) of the plant or cut stump. Chemical herbicide which may be used are as follows: Triclopyr 480g/l, Metsulfuron-methyl 200g/l, Metribuzin 480g/l. Rate of using the herbicide depends on type of method used whether a foliar application or basal bark application. Control of Siam weed is effective if done before flowering.

The reported control method for *Astripomoea hyoscyamoides* involve uprooting, cutting before flowering as well as mowing frequently when still young. All these need enough labor and are costly if control has to be at a large scale (Nkombe *et al.*, 2018).

The control of Mauritius thorn can be done mechanically by cutting and burning during the dry season followed by immediate removal by hand of any seedlings that may emerge. The stems can be girdled close to the ground or stem can be debarked. Alternatively, the species can be controlled by using chemicals namely Glyphosate (L1488) and Triclopyr (L3249).

2.4.3 Fisheries Sector

National Fisheries Policy and Strategy Statement of 1998 underscore the importance of protecting fisheries resources and aquatic environment by discouraging the introduction and translocation of exotic species between water systems unless sound scientific evidence guarantees safety of genetic integrity of the water ecosystems. Further, the Fisheries Act No 22 of 2003 section 22 (1) (d) prohibits importing or exporting of fish, fish products, aquatic flora or products of aquatic flora unless one applies for, and granted by the Director or any other authorized officer a license in respect of such activity (URT, 2003:20).

Control efforts of Water hyacinth in East Africa was done in the 1990s by using bio-control agents *Neochetina* species which was implemented under Lake Victoria Environmental

Management Programme (LVEMP) and which reduced its rate of spread. Nevertheless, the species is now widely spreading in Lake Victoria and other rivers such as the Ugalla River (Bukombe *et al.*, 2011). Water hyacinth is currently threatening the lives of other organisms and reducing fish production in the area (Masifwa *et al.*, 2001; Gichuki *et al.*, 2012).

To prevent importation and translocation of fish for fish farming without negatively impacting on fish farming industry, hatcheries for serving fish farms within watershed should be established. This needs to go along with selective breeding studies to come up with commercially competitive fish breeds against the imported breeds. Promotion of indigenous species in fish farming such as *Oreochromis variabilis* in the place of *Oreochromis nilotica* in Lake Victoria Basin is also of critical importance.

2.4.4 Forestry Sector

Forest Act No 14 of 2002 Section 69 recognizes the importance of ensuring the sovereignty over biological resources in forests (URT, 2002). The issue of invasive alien species has not been directly addressed by this Act. However, there are some provisions in this Act that indirectly implies the issue of invasive alien species and environmental impact assessment before any development within the area. The provision regarding developments include various ranges of development which aim to improve or change the characteristic of the native species in any area of the land, and this move may include the introduction of the new species in order to develop the desired types of the forest, which in turn will lead to the outbreak of invasive alien species.

Acacia mearnsii commonly known as Black Wattle is removed by clearing the mature trees and a follow up of uprooting regenerating seedlings after rain seasons.

Control of *Prosopis* involves physical methods by cutting and uprooting stumps, whereby roots must be removed at least 15 cm below the ground. Chemical methods involves: application of herbicides on cut stumps and the bark of the stem up to 75 cm (basal bark). The preferred chemical is Triclopyr. Biological method uses a leaf tying moth of the genus *Evippe* that has been tried in Australia and South Africa and found effective. Awareness creation is being done to ensure that the species is destroyed once observed in nearby reserved forests

Cedrela odorata was estimated to cover about 32% of all big trees (Dbh > 10 cm) in Kimboza Forest Reserve. The tree species has also been observed expanding in Amani Nature Forest Reserve. Both mechanical and chemical control of the species has been tried with little success. Efforts are made to ensure that the tree species is prevented from invading other forests and the existing invasions are monitored.

2.4.5 Wildlife Sector

Most interesting is that the wildlife sector appears most alert and prepared regarding the problem of invasive species. So far there are more than 100 species that are known to occur in the protected areas and the management of these are within the protected areas monitoring and evaluation programs. The NCA and TANAPA set quite a good example of the invasive species management efforts whereby millions of funds are so far spent annually to fight the problem. Existing protected areas Policies, Acts and Regulations prohibit any alien species into the areas.

Management of invasive species in the invaded protected areas poses great challenges as protected areas in Tanzania are meant to enhance nature resilience. Management approaches that in one way or another can cause unintended negative outcomes on wildlife species and habitats cannot be practised within protected areas, especially the National

Parks and Nature Reserves. For example the use of chemicals such as herbicides and even biological control may have strong negative effects on native flora and fauna and hence are not always practical. This calls for emphasis on physical approaches such as uprooting, slashing or mowing. When the physical approaches are costly, other alternative management options that are both ecologically friendly and effective are applied.

In the Ngorongoro Conservation Area for example, efforts to control invasive species, especially *Gutenbergia cordifolia* and *Eleusine jaegeri* started since the 2000s using mechanical approaches such as frequent mowing /slash /uprooting. Since then, the process has been less successful. Further efforts have been initiated to address the challenge, NCA has established collaborative approaches with experts from the Nelson Mandela-African Institution of Science and Technology (NM-AIST), to try the use of nature based approaches which utilize native plant species *Cynodon dactylon* and *Desmodium intortum* as competitors for *G. Cordifolia*, *Tagetes minuta* and *Bidens schimperi*.

This approach has been tested successful both in the controlled small scale field environments in the NCA and it is expected that following successful upscale trials of the approach, it will be adopted by NCA and will be extended to other affected areas and ecosystems. As the control of invasive species in protected areas is a more sensitive and expensive process, there is need to ensure all pathways are well understood and incorporated into an early detection mechanism that banks into regular monitoring and management.

2.5 CHALLENGES FOR MANAGING INVASIVE SPECIES IN TANZANIA

The management of IS has been difficult as they are a cross-sectoral problem and have challenged the traditional thinking in terms of sectors and geographic boundaries. Some other challenges around this also relate to dynamics around shifts and changes to land-use, climate, population, a biotic and abiotic factors that are often not accounted for in the respective sectors and ministries. Therefore, finding far reaching solutions to managing IS would require incorporation of these issues into implementation plans and management actions into the respective sectors including addressing this through better land use planning and other sustainable solutions that can look at this beyond implicit management of IS.

In Tanzania, the management of IS have been dealt with by individual sectors and in isolation through a single department or section. In many cases IS management was through various projects and by support of development partners, and hence success has been only in small scale. Furthermore, the problem had not been given due publicity and declared to be a serious problem that require multi sectorial approach to finding solution. So generally, management of IS in Tanzania has encountered a number of challenges including but not limited to; lack of harmonization of IS in policy and regulatory tools, inadequate enforcement of the existing ones, inadequate inter sectoral collaboration and coordination, inadequate management of pathways and vectors of introduction of IS to the country, inadequate knowledge on invasive species management in Tanzania and inadequate capacity to manage invasive species. Strategies for long-term management of invasive species will mean deriving lessons and feedback from the implemented short-term strategies. These will then be used to develop long-term forecasting of managing the invasion process and mechanisms that are beyond the already emerged and spread of existing invasive species and this would include aspects such as climate change, population increase, increased free market economy and unsustainable land conversion. More details about these challenges are presented in the next paragraph.

2.5.1 Lack of harmonization of IS in policy and regulatory tools, and poor enforcement of the existing ones.

Analysis has shown that there is a wide gap in the policy and legal framework, in addressing the problem of IS in Tanzania. Fortunately, EMA2004 has a clear framework of implementation from national level to village level. Even though, the issue of IS has been well captured but there is no relevant regulation, to facilitate a collective responsibility. Majority of these sectors have not mainstreamed the issue of IS in their sectorial policies and legislation. Hence, this alone plays a significant role to the fast spread and establishment of IS in the country.

Sectoral policies are an important tool for having effective legal frameworks that can effectively address national challenges including alien and invasive species. Analysis of existing policy, legislative, and regulatory tools has revealed that majority of the existing policies that were developed in 1990s and 2000s do not address well the issue of IS (Table 8; Appendix 4). This is due to fact that the impacts of IS have only been recognized in recent years. Of the ten (10) reviewed policies of the most relevant sectors for instance, only 10% fully addressed IS while majority remained almost silent (Table 9). The weaknesses observed under the current policies has further manifested in most of the operating institutional Acts. It was found that the majority of the reviewed Acts (76%) in the most relevant institutions either partially or do not address IS issues (Table 9; Appendix 4). Likewise, the effect is vivid in the existing Regulations, whereby only 25% of the reviewed Regulations fully addressed invasive species (Table 9). The majority of the Conventions / Agreements (47%) which Tanzania has ratified partially address invasive species (Table 9).

Furthermore, for those sectors which have Policies, Acts and Regulations with IS included, the level of enforcement has been very low. Some sectors have incomplete regulatory tools regarding IS management. For instance, there are cases where a Policy exists acknowledging the presence of IS, while the respective Act(s) don't and no Regulations in place to allow for enforcement of the Act(s).

Table 8: A summary of reviewed National Policies and Legal Frameworks

S/N	Policy	Acts	Regulations
1.	National Environmental Policy (1997)	National Environmental Management Act (2004)	<i>*National Environmental Management Regulation</i>
			Environmental Impact Assessment and Audit Regulation (2005)
			The Environmental Regulation (Biosafety) (2009)
2.	National Forest Policy (1998)	Forest Act (2002)	Tanzania Forest Regulation (2004)
3.	National Fisheries Policy (2015)	Fisheries Act No. 22 of 2003	Fisheries Regulation (2009)
		Tanzania Fisheries Research Institute Act (2016)	<i>*Tanzania Fisheries Research Institute Regulation</i>
		Deep Sea Fishing Authority Act (1998)	Deep Sea Fishing Authority Regulations (2009)
4.	National Land Policy (1997)	Land Act CAP 113 (1999)	<i>*National Land Regulation</i>
		Village Land Act (1999)	Village Land Regulation (2001)

S/N	Policy	Acts	Regulations
5.	National Livestock Policy (2006)	<i>*National Livestock Act</i>	<i>*National Livestock Regulation</i>
		Grazing land and Animal Feeding Resources Act No. 13 of 2010	Grazing-Lands and Animal Feed Resources (Pasture Management Practices) Regulations (2012)
			The Grazing-lands and Animal Feed Resources (Safeguarding, Development and Sustainable Use of Grazing-lands) Regulations, 2012
		The Animal Disease Act (2003)	The Animal Diseases (Appointment and Duties of Inspectors) Regulations, 2005
6.	National Agriculture Policy (2013)	<i>*The National Agriculture Act</i>	<i>*National Agriculture Regulation</i>
		Plant Protection Act No. 13 of 1997	The Plant Protection Regulation (1998)
		Seed Act (2003)	The Seeds Regulations (2007)
		Tanzania Agriculture Research Institute Act (2016)	<i>*Tanzania Agriculture Research Institute Regulation</i>
7.	Wildlife Policy (1998)	Wildlife Conservation Act No. 5 of 2009	<i>*Wildlife Conservation Regulation</i>
			Wildlife Conservation (Wildlife Management Areas) Regulation (2018)
8.	The National Policies for Tanzania National Parks (2011)	The National Parks Act No. 415 of 1959	<i>*The National Parks Regulation</i>
			Non-Consumptive Utilization Regulations 2007
9.	Construction Industry Policy (2003)	The Contractors Registration Act (1997)	<i>*Construction Industry Regulation</i>
10.	National Transport Policy (2016 Draft)	<i>*National Transport Act</i>	<i>*National Transport Regulation</i>
		Surface and Marine Transport Regulatory Authority Act (2001)	The Railways (Handling and Transportation of Dangerous Goods) Regulations (2008)
		Merchant Shipping Act No. 21 of 2003	Merchant Shipping (Ship and Port facility security) regulations (2004)
		Tanzania Civil Aviation Act (2006)	The Tanzania Civil Aviation Ground Handling Services Regulations, 2007

Table 9: A summary of reviewed Policies and Legal Frameworks showing the current level of addressing invasive species

Level of addressing alien and invasive species	Reviewed policy and legal frameworks				
	National policies (10)	National acts (16)	National regulations (16)	National & Regional strategies (7)	Multilateral agreements (17)
Not at all	40%	38%	38%	14%	18%
Partially	50%	38%	38%	43%	47%
Fully	10%	31%	25%	43%	35%

2.5.2 Inadequate inter sectoral collaboration and coordination

Many stakeholders from within and outside the country are affected by the problem of IS. There exist a number of independent projects operating at different success levels within the country, trying to prevent, eradicate and manage the impacts caused by IS. Lack of cross-sectoral coordination countrywide, has hampered the success of different projects implemented in the country to curb IS. Isolated efforts are very costly and hardly successfully. There is an insufficient alert system and cooperation among sectors which has caused the problem to extend to unmanageable level resulted to the highest levels of problems in the sectors. The same species can be vectors or weeds, for example, and can as well be pests of agriculture, livestock and of conservation importance. Hence, a continuum of habitats must be recognized, rather than separating for instance, agriculture from conservation. Therefore, a successful fight against IS would require bringing together various stakeholders, knowledge, tools, and approaches from a range of relevant disciplines.

Thus, there is a strong need for a National Strategy, which among others to provide effective and coordinated framework and efforts to prevent further introduction and spread of invasive species as well as to develop sustainable solutions to manage the existing invasions.

2.5.3 Inadequate management of Invasive Species pathways to the country

Analysis has shown that, generally, there is inadequate knowledge of, and management of the means through which IS enter the country, such as country borders and customs, sea and land ports. The means through which IS spread in the country, or vectors of spread, face a similar non-enforcement against IS. These include fishing gears, animals, vehicles, boats and ships. Transportation of animal feed from one part of the country to another, farm crops, livestock and other material, are often infested with IS and in absence of clear and strategic management, the problem of IS is likely to prevail. Such Strategy should include risk assessment during emergence operations such as during famine and aid missions, in order to ensure that IS are not introduced to the country, or spread from one area to another within the country. On the other hand, there is a huge potential for rapid response if early detection is enabled by the community, whereby they can properly identify IS and take appropriate action rapidly to prevent IS establishment.

2.5.4 Inadequate knowledge on Invasive Species management in Tanzania

Generally, the majority of the Tanzanian population are not aware of the economic, social and environmental impacts caused by IS. This inadequacy of knowledge is such that even those who promote environmental protection, government and NGOs, have been promoting afforestation using some of IS. Education curricula in our schools and colleges

lack comprehensive topics on native versus alien invasive species. This situation calls for a strategy towards change in long rooted behavioural practices through multi-spectra approaches to reach all types and levels of stakeholders for a collective action.

2.5.5 Inadequate capacity to manage invasive species

Successfully addressing the problem of IS requires both national will and capacity to act. Capacity can be categorized in two: knowledge on what needs to be done, and resources to get it done. Currently there are no guidance priority research areas on the topic of IS in Tanzania. A number of notably significant studies have been conducted and published, but there is a lack of a coordinated forum for information sharing. This situation has contributed to the expenses of IS management, due to the fact that effective management measures are not well known to affected parties. On the other hand, there is a general scarcity of resources to manage IS in terms of required skills and knowledge, equipment and tools as well as funds. Obtaining adequate, stable, long-term funding for IS management is a serious challenge, particularly when the potential economic benefits of managing IS are not fully understood by the public or by all decision-makers. Therefore, research to fill information gaps, as well as resources mobilization and coordination, will go a long way to reducing the IS challenge.

2.6 PROPOSED SOLUTIONS FOR MANAGING INVASIVE SPECIES IN TANZANIA

In recent decades, science has seen a gradual increase in invasive species both in land and water due to increase in human population and climate change, human activities, as well as unsustainable land conversions. This observation is challenging the players and stakeholders to think beyond direct ways of dealing with invasive species to ways of developing adaptive capacity and paradigm shift to include aspects such as proper land use planning and habitat management focus that move away from traditional IS management towards balancing the approaches that deal with existing IS with those that address underlying and emerging causes and mechanisms of invasion. Thus, IS management approaches should include issues such as climate change adaptation and mitigation, better land use planning as well as population and water use regulations in relation to the dynamics of this in time and space of both existing and currently unknown IS. The recognition and inclusion of this in the respective sectors and strategic objectives stated in the next section would help realize the achievement of sustainable management of IS. Thus, the NTF has developed proposals for managing IS and these are indicated in the sub-section below but the implementation of this would need recognition of the issues presented in the next section (the Strategy itself).

2.6.1 Mainstreaming Invasive Species into regulatory tools

Tanzania has a quite number of Policy and Legal Frameworks that address various issues on biodiversity conservation and management. Majority of these Policy and Legal Frameworks either partially or fully addresses invasive species, therefore provides an opportunity for developing effective IS policy and Legal Frameworks. Although Tanzania has a good number of policy and Legal Frameworks that address various issues on biodiversity conservation and management, currently there is no independent Policy and or Regulation that specifically (solely) address IS. Most of sectoral Policy and Legal Frameworks dealing with biodiversity and ecosystem conservation addresses either partially or not at all issues of IS. A legal framework for IS in Tanzania should as a minimum requirement, cover but not limited to the aspects of early detection, prevention, rapid response, control, awareness creation and capacity building as well as insisting on collective responsibility for invasive species management on privately owned lands.

Environment and natural resource management in Tanzania are guided by broader National Strategies and Plans mainly the Tanzania Vision 2025 and the National Five Year Development Plan 2017-2021. Likewise, there are sectoral policies and legal instruments all of which provide policy, strategic and legal basis for the Environment and natural resource management to ensure sustainable development. Other frameworks include strategies as well as various Multilateral Environmental Agreements (MEAs) and their subsequent decisions in which Tanzania has ratified. The main sectoral policy and legal frameworks which govern environment and natural resource management as well as biodiversity conservation in Tanzania include: The Wildlife policy of 1998, Forest policy of 1998, Tanzania National Parks Policy 2011, National Environmental Policy 1997, Wildlife Conservation Act No. 5 of 2009, the Forest Act of 2002, the Environment Management Act, 2004, The National Parks Act No. 11 of 2003, The Ngorongoro Conservation Area Ordinance No. 413 of 1959 and the Marine Parks Reserves Act No. 29 of 1994 and Plant protection act no.13 of 1997. Although these are the most relevant policy and legal frameworks required to address issues of invasive species, most of them are sector-specific and were formulated in different times with different emphasis, depending on the pressing needs of that particular time.

Policy formulation is a crucial step in establishing an effective legal framework that can govern respective institutions. It is from effective policies that strong and implementable acts, regulations and guidelines can be formulated. As recently, the impacts of IS have started to manifest, not only in the biodiversity conservation sector but also other sectors including agriculture and fisheries (Ogutu-Ohwayo, 1990). Majority of the existing policies are of long time (Figure 4) in such a way that they do not address well the issue of IS (Appendix 4). Majority of the policy have remained almost silent on issues of IS. For effective control of IS there is a need to mainstream IS in these policies.

Effective Acts depends much on existing well formulated policies. Poor Policies normally results into poor Acts. The weakness observed under the current Policies has manifested in most of the operating institutional Acts. Like most Policies, only seven (7) recently Acts: Environmental Management Act 2004, Fisheries Act No. 22 of 2013, Tanzania Agricultural Research Institute Act (2016), Tanzania Fisheries Research Institute Act (2016), The Animal Diseases Act (2003), the Plant Protection Act (1997) and The Electronic and Postal Communications Act (2010) equivalent to 32% fully addressed IS issues. Majority of the Acts partially addresses IS (50%). This gives a clarion call to revise the relevant Acts so as to fully address IS for effective implementation. Specific recommendations for each Act are provided in Appendix 4.

Effective Regulations are a product of effective Acts, a weakness was observed in the existing Regulation with regard to IS as majority of Acts either did not address (38%) or partially addressed (38%) issues of IS. Of the reviewed regulations only Seeds Regulations (2007), the Environmental Impact Assessment and Audit Regulations (2005) and Plant Protection Regulation (1998) fully addressed issues of IS 31% (Figure 4). Formulating effective sectoral policies and Acts, therefore is an important step into having effective National Regulations that can effectively address national challenges including IS. Unfortunately, review of the most recently bills and amendments in most relevant sectors (Table 10) indicates that most of amendments and bills did not addressed IS, for instance; The Wildlife Conservation Act 2017 (Amendment bill), The Forest Regulations 2017 (Amendment bill), The National Shipping Agencies Act 2017 (Bill), The Land Transport Regulatory Authority Act 2018 (Bill), The Immigration Act 2014 (Amendment) and the Tourism Agents (Registration and Licencing) Regulations 2015 are silent on IS. It is high time such bills and amendments to take into consideration issues pertaining to IS.

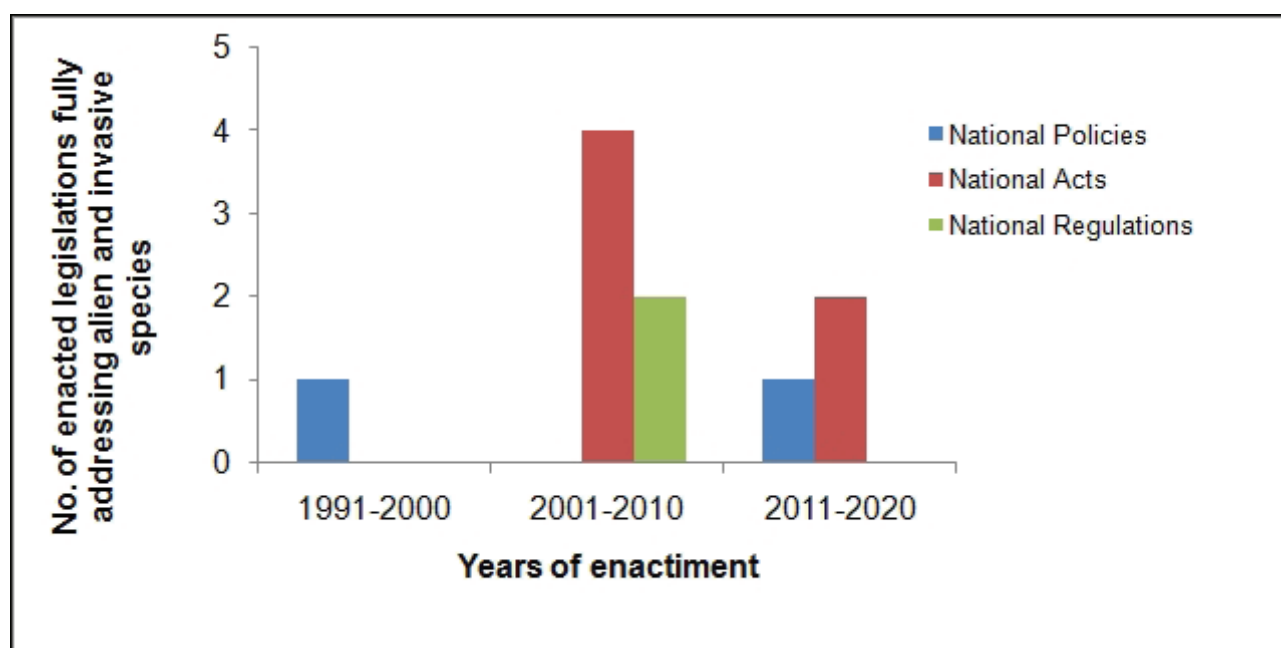


Figure 4: Showing years where some national Policies, Acts and Regulations started to fully address alien and invasive species

Table 10: A summary indicating recent legislations amendments and bills in most relevant sectors

S/N	Sector	Legal framework (Bills and amendments)	Status of addressing Invasive species
1.	Wildlife	The Tourism Agents (Registration and Licencing) Regulations 2015	Not addressed
		The Wildlife Conservation Act 2017 (Amendment bill)	Not addressed
2.	Forestry	The Forest (Amendment bill) Regulations 2017	Not addressed
3.	Environment	No new bill and or amendment	NA
4.	Agriculture	No new bill and or amendment	NA
5.	Transportation	The National Shipping Agencies Act 2017 (Bill)	Not addressed
		The Land Transport Regulatory Authority Act 2018 (Bill)	Not addressed
6.	Land	No new bill and or amendment	NA
7.	Immigration	The Immigration Act 2014 (Amendment)	Not addressed

*NA=Not applicable

While other national strategies such as Agriculture sector Development Strategy (2016-2025), The Tanzania Development Vision 2025 and Tanzania National Five Year Development Plan 2017 – 2021 (Appendix 4) are partially addressing IS, efforts have to be taken to ensure that they fully address IS for effective implementation. Nevertheless, national effort to formulate

sectoral strategies particularly for those sectors whose operations are likely to contribute to the problem of IS is crucial.

Tanzania has ratified a number of international agreements associated with environmental and biodiversity conservation (Appendix 4). But only a few of the ratified agreements have been effectively adopted in our existing policy and legal frameworks for implementation. Among others, Tanzania has ratified the Convention on Biological Diversity (CBD) and the Aichi agreement which she has managed to address both of them by establishing her National Biodiversity Strategy and Action Plan (NBSAP) (2015-2020) in which under target 9, alien invasive species are well addressed. The way forward for the NBSAP therefore, is to ensure that it is channelled through existing policy and legal frameworks for it to be effective.

Tanzania has further ratified Convention on Sustainable Management of Lake Tanganyika (2003), the Agreement of the Conservation of African-Eurasian Migratory Water Birds (AEWA) (1999), the United Nations Convention on Law of the Sea, Montego Bay (1994) and the International Plant Protection Convention (1951) which address both plant and environmental protection. All of these conventions / agreements fully recognize the threat of alien invasive species and call upon effective actions to be taken by member states; moreover majority of conventions / agreements (47%) which Tanzania has ratified partially address alien and invasive species (Table 8) it is therefore our responsibility as a member state to ensure that the goals of these agreements are streamlined in our national policy and legal frameworks so as to achieve desired positive effect (Appendix 4). As member state it is also our responsibility therefore to ensure active representation to the conferences of parties (COP) meetings so that, current issues on invasive/alien species and other environmental challenges are well addressed.

2.6.2 Strengthening Coordination on IS Management and Information System Sharing

The capacity of the government to manage IS depends on available scientific and socio-economic information. Current management practice of IS is fragmented, that is each sector is doing research and management approach at their own capacity and utilizing information for their own sector, despite the fact that the issue of IS is cross cutting. There is no central coordination and reporting for IS situation and management. Therefore there is a need to establish coordinated, up to date information sharing platform, in which each sector will share available information to a centralized coordination unit for compilation and the compiled information to be shared to general public. There should be guidance on agreed format for IS reporting.

During field visit of the task force and through interviews, it was found that there are a number of activities that are done by sectors in managing invasive species. For example in Wildlife sector, institutions like Tanzania National Parks (TANAPA) and Ngorongoro Conservation Area are doing a tremendous job in IS management, having a plan and budget for control and monitoring IS in their areas. In Forestry, Agriculture, Livestock and Fisheries sectors there is also research and management options that are addressed to community for invasive species control (Appendix 3).

Results of the assessment showed that IS issue is not coordinated by environmental sector units in many ministry, but experts in department that are technically responsible for specific invasive species. Example; weed expert, entomologist, ecologist, pathologist, taxonomist, botanists, zoologist etc. In general, sector ministry, academic and research institutions are doing work in research and management of invasive species. In managing this, there are a number of challenges that were observed:

1. Invasive species information sharing across sector is inadequate,

2. Inadequate resources for IS surveillance, research and management programs,
3. Inadequate effective coordination of IS management across sectors.

In this case, there is a need to develop a system to share information within and across all sectors. This will ensure avoidance of duplication of efforts among stakeholders and experts, and it will stimulate effective collaboration and coordination among stakeholders including general public and private stakeholders. Information, which is usually in technical and scientific language, should be translated in a language that can be understood by communities. Communication to the general public is important for community to understand the threat and problem of IS. Public awareness will help in identification, early detection, prevention, reporting and control of IS. In this case it is suggested that there should be information available through online bulletin in sector Ministry's websites. This is important for the employee in the respective sectors to be aware of the problem and the work which is done on invasive species within the ministry and sector in general.

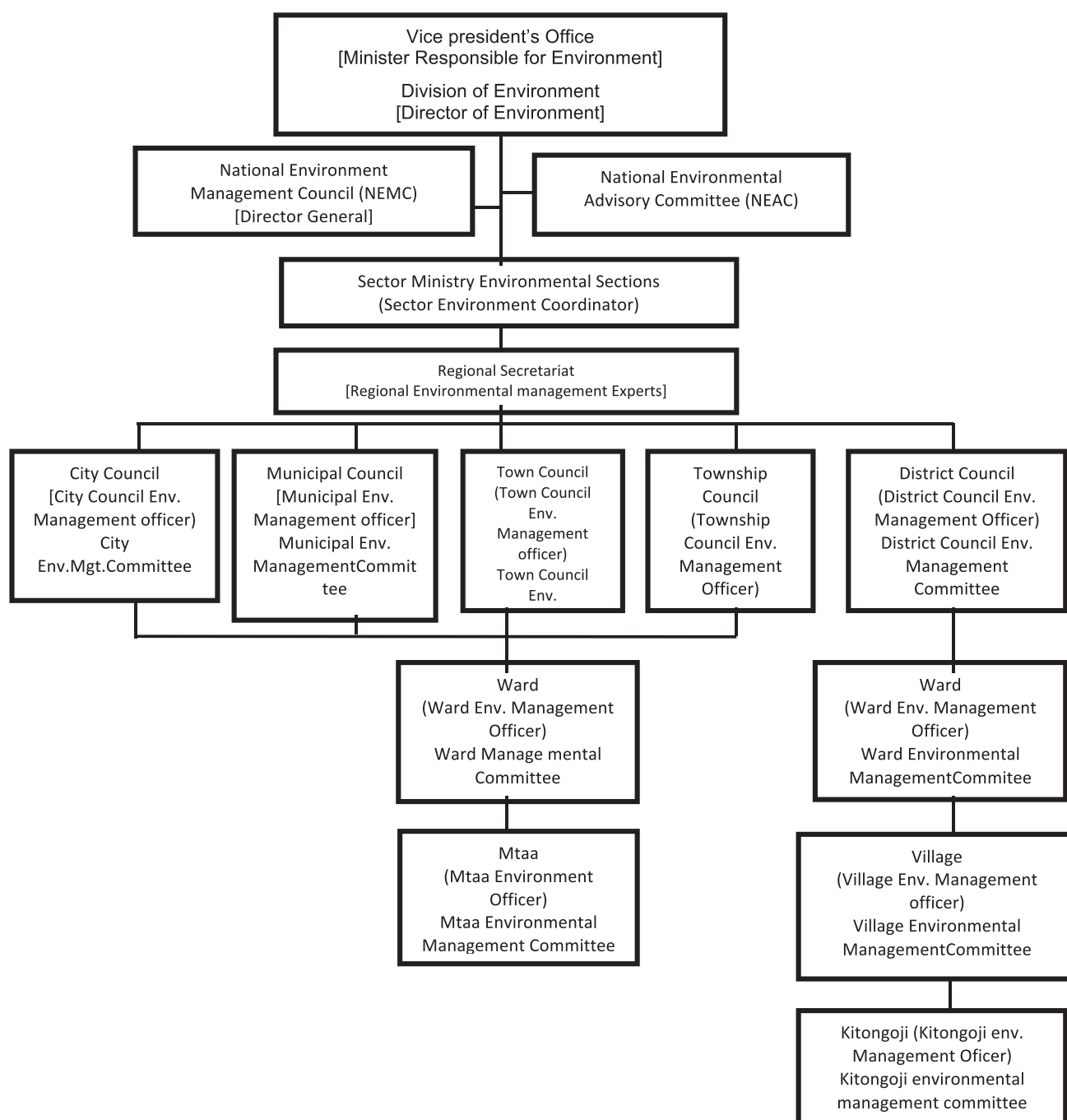
2.6.2.1 Existing Institutional Framework for Environmental Management in Tanzania

The institutional arrangement for management of environmental issues in Tanzania has been established by the Environmental Management Act (EMA) No. 20 of 2004 (Figure 5). The EMA confers the task of overall coordination and policy articulation of environmental management in the country and provision of the central support functions to the Ministry Responsible for Environment, which is the Vice President's Office.

In order to effectively facilitate coordination and communication on environmental management issues that includes biodiversity, the Government has established Environmental Coordination Units in all Sector Ministries and designated Environmental Management Officers in Local Government Authorities at City, Municipality, District, Township, Ward, Village, Street and Hamlet levels.

The Act establishes the National Environmental Advisory Committee (NEAC) with the role of advising the Minister responsible for environment. It confers the role of enforcement to the National Environment Management Council (NEMC). The Act further directs establishment of Sector Environment Sections with the role of overseeing environmental management to such respective sectors. It also gives power to the Regional Secretariats to designate Regional Environmental Management Expert (REME) charged with responsibility to advise and oversee implementation and enforcement of EMA. Furthermore, the Act empowers Local Government Authorities (LGAs) in the Cities, Municipals, Districts, and Townships and up to Village level to designate or appoint Environmental Management Officers to oversee implementation of EMA at respective levels. In addition, the Act directs the establishment of the Environmental Committees at different LGAs levels to advise and oversee the implementation of EMA within their jurisdiction.

Figure 5. The existing institutional arrangement for environmental management in Tanzania



Despite good efforts that have been taken to develop the institutional framework, there are a number of challenges that hinder effective coordination and communication of this within and across sectors:

- i. Inadequate coordination among the key stakeholders,
- ii. Low capacity (human & financial resources and infrastructure),
- iii. Low level of public awareness of the existing frameworks,
- iv. Inadequate financial resources for implementation, monitoring and evaluation,
- v. Insufficient operational involvement of local authorities and communities in environmental management and conservation,

- vi. Lack of management and operational plan for IS network,
- vii. Inadequate coordination of existing environmental issues including IS,
- viii. Lack of budget vote in the regional secretariat on environmental management issues.

Further to the challenges above, analysis on the Strength, Weaknesses, Opportunities and Challenges (SWOC) was carried out by the NTF and stakeholders during the consultative workshop on the existing environmental coordination and communication framework and the observations summarized on Table 11 below.

Table 11: An analysis of strength, weakness, opportunities and challenges (SWOC)

Strength	Weaknesses	Opportunities	Challenges
- Existence of National and International legal frameworks supportive of the Strategy, - Existence of political will to manage IS, - Existence of a strong need for management of IS, - Existence of a well-defined & operating environmental management system and structures, - Availability of substantial information on IS key species distribution, spread and impacts, - Existence of management solutions for some IS, - Existence of inter-and – intra sectoral and institution system for sharing information on IS, - Existence of National Communication Strategy on Environmental Sustainability, Growth and Poverty Reduction (2015-2019), - Existence of framework for management of environmental issues.	- Low level of public awareness, - Inadequate financial resources, - Inadequate extension services, - Inadequate mainstreaming of invasive species issues in sectoral policies and legislations, - Uncoordinated and fragmented management efforts, - Lack of national guidelines for introduction and management of IS, - Unregulated introduction pathways for IS, - Inadequate specialists on IS, - Inadequate research and monitoring, - Inadequate law enforcement, - Inadequate response to IS. - Inadequate control of goods and services movement across the border, - Weak phytosanitary systems , - Inadequate capacity to detect and implement management measures,	- Strong collaborations with sectoral ministries, - Availability of potential partners to support management of IS, - Collaboration with International, regional and local institutions, - Existence of potential options for utilization of IS.	- Utilization of IS by the community, - Introduction of new IS species, - Declining Development Partner funding, - Inadequate control of people and livestock movement across national borders.

Strength	Weaknesses	Opportunities	Challenges
	• Low levels of awareness, knowledge on presence and impacts of IS. • Weak and uncoordinated enforcement of IS legislation, • Utility value of IS found in Tanzania remains largely unexplored and un researched, • Lack of component on IS in the communication strategy.		

It is recommended that, the existing institutional framework for the environmental management in Tanzania (Figure 5) be adopted and operationalized to coordinate and communicate invasive species management. This is due to the fact that, the intra and inter-sectoral linkages and communication on environment matters are shown clearly from grass root level up to the Minister responsible for environmental issues. Since issues of invasive species affect all sectors, it is appropriate that they are mainstreamed into this framework. Although, there has been a slow pace on dealing with environmental concerns including IS at these levels, we argue each sector and institutions within this framework to institutionalize and operationalize invasive species matters into this model by mainstreaming them in their sectoral and organization framework.

This could be possible by putting up more efforts towards the implementation of the framework including developing and strengthening capacity and awareness of environmental officers and responsible committee of all levels (from grass root level to decision makers). The importance of strengthening capacity and awareness of all stakeholders in addressing and coordinating environmental issues including IS should be emphasized in each of the respective units and Departments to enable effective management of IS. Moreover, it is also recommended to share best practices and success stories on management of IS among Local Government Authorities. Furthermore, the use of uniform reporting format/ template to all environmental and other officers and responsible committee is recommended (Appendix 11). This could help to have clear and consistent information on matters related to IS flow from all stakeholders. The report should include information on the spread and management of the IS, impact and their monitoring and evaluation if known.

2.6.2.2 Existing Institutional Framework to deal with disasters in Tanzania

Tanzania like any other countries is not immune to disaster occurrence and incidences and these sometimes come without any preparedness in place. However, in case they occur, there is a need to consider options for dealing with such events even when their level of preparations is not perfected. Disaster is an occurrence or series of occurrences, whether natural or man-made calamity that causes or poses a significant disruption or threat to the functioning of a community or caused widespread human, material, economic or environmental loss or impact which exceed the capacity of that community to cope with the disaster using its own resources (The disaster Management Act, 2015). Disaster management department is under Prime Minister's Office and is responsible for the overall disaster management in the country. In executing its duty it has a system of information and

management from village level to national level. This makes it easy in fulfilling its duty of disaster risk reduction and management.

According to Disaster Management Act, 2015 there is establishment of Disaster Management Committee at village level to regional level. And at national level there is Disaster Management Governing Council and Disaster Management Agency. The system works from national to village level. The functions are as follows:

- **Village Disaster Management Committee:** Village committee members are selected based on criteria stated in the Act, their functions are;
 - to oversee and coordinate disaster risk management and emergency operational at village level.
 - to act as clearing house for information related to early warning, mobilize resources.
 - to implement public information and public awareness program in the village.
 - to respond in a coordinated manner to any emergency situation at village level. It is stipulated that in discharge of its functions, the Village Committee shall, as much as practicable use customary law, traditional practices and indigenous methods of warning and communication.
- **Ward Disaster Management Committee:** Ward committee members also are selected based on criteria stated in the Disaster Management Act, 2015. The functions of the committee are: to oversee and coordinate disaster risk management and emergency operations at ward level, facilitates the implementation of disaster management programs for the ward, mobilize resources and to respond in a coordinated manner to any emergency situation at a ward level.
- **District Disaster Management Committee:** At district level there is District Disaster Management Coordinator together with District Disaster Management Committee, District Coordinator serve as a secretary to District Disaster Management Committee. The functions of the committee includes: Advice the District Commissioner on the disaster management matter and activities performed at district, to oversee and coordinate disaster risk management and emergency operations at district level, and to mobilize Aresources in respect of disaster management. Also the Act stipulates the power of Committee that is to direct all institutions in the districts/regions to prepare for, prevent or mitigate disaster.
- **Regional Disaster Management Committee:** Regional Disaster Management Coordinator is a secretary to Regional Disaster Management Committee. The committee have the following functions among others: Advice the Regional Commissioner on the disaster management matter and activities performed at a region, to oversees and coordinate disaster risk reduction, management and emergency operations among government sector institutions, local authorities, communities and other role players involved in disaster risk reduction management, mobilize resources, to align regional early warning system and facilitate the establishment of regional disaster risk information database in coordination with the disaster management agency/department and to coordinate district plan on the prevention of disasters and their mitigation submitted by the District Committee.
- **National:** At national level there is two bodies, one is Disaster Management Agency and the Director and second is Tanzania Disaster Management Governing Council.
- **Function of the Director:** A national focal point for the coordination of disaster

risk reduction and management. Responsible for convening emergency meetings of the Council to deliberate the situation, to establish early warning system covering all sectors and maintain close links with different institutions that provide warning services and to coordinate and monitor inter-ministerial, multisectoral entities and technical committees responsible for disaster management at all levels.

- **Tanzania Disaster Management Governing Council:** Members of the Council including others, are Permanent Secretaries in relevant ministries. The functions of the Council among others are to ensure disaster risk reduction interventions are integrated into relevant government institutions, development policies, strategies and programs at national, regional and local levels, to advocate the development of national information and knowledge management strategies and establishment of stakeholders networks for disaster risk management.

In analysing the disaster management system and how it works, it shows that the management of the disaster start at a village level, to national level. It shows also that the local level from village have responsibilities in managing disaster at their level which include monitoring and issuing early warning, control and report the intervention information to the next higher level and when the management is beyond their capacity, they report to next higher level for assistance. It is emphasizing also the use of indigenous methods in interventions of disaster which reflect the involvement of the whole community. It is high time that as a country, we consider IS issues as part of inclusion into the disaster and risk management especially when we experience emergency or outbreak of IS at a given location on a given point in time. Such management actions would be adopted by each sector and would be in the form of rapid response, thus, enhancing the effectiveness in the management of the IS.

2.6.2.3 Existing Institutional Framework to deal with Invasive species in Tanzania

Invasive species occurrence in Tanzania is not a new phenomenon. It has been there for years, but the magnitude of invasions and impacts have increased in recent years in all sectors as stated in the preceding sections. The aim of this section is to analyses the information on practices on invasive species reporting and interventions.

Normally invasive species occurs in our localities, that is village, ward, district and regional levels. Interventions towards control, management, assessment and research to address the problem are carried out in these areas. The interventions are done in collaboration between local community, local authority, sector ministry and sector institutions. Studies on current system through interview of the sectors show that there is relevance in reporting format and interventions. It was found that there is flow of information within the sector and there are interventions with the sector. For example the recent invasion of Fall armyworm in Agriculture sector, Prosopis in forest sector, Gutenbergia in wildlife sector, Kongwa weed in livestock sector etc.

Once the invasion is observed in certain locality, local community reports the incidence of the problem to relevant expert at village level for solution. If solution for intervention is not achieved, then the village passes the information to ward level, if at ward level the intervention fail it is passed to district then to region and at a regional level. Where there is no solution it is usually passed to sector ministry or sector institutions (university, research institution or regulatory authority) for identification of the problem and interventions. This is how information moves from village level to higher authority.

2.6.2.4 Proposed reporting channel in institutional framework for management of IS in Tanzania

Local community at sub- village, village, ward and district level should report on invasive species concerns to Regional Environmental Management Officers, who report directly to DE. However, Sector ministries after receiving the information on invasive species from Local Government Authorities in respective of their sectors should report to DE. DE will process the received information and produce various documents including reports, brochures and announce early warning where appropriate to the general public. The information to be reported should include but not limited to (Appendix 11); the name of invasive species, its life form, means of spread if known and their potential impacts. When the species is not known to the area, should be reported for identification. The reports should include success stories of any practices carried out in areas of invasion or elsewhere. Furthermore, if the reported case requires more research, DE will forward such information to the respective sectoral research institution for immediate action.

Some of the proposed goals that need to be implemented by the Unit within the Division of the Environment may include early detection and rapid response, prevention, eradication and control of invasive alien species as well as capacity building and awareness creation among the stakeholders. All this will involve stakeholder engagement and feedback process that will gather the necessary suggestions for building on the existing strengths and opportunities.

Based on the study on three systems above, Environmental management reporting structure, Disaster management system and current information sharing system on invasive species, it is proposed that there should be a central information coordination unit for invasive species (VPO). Also it is suggested that there should be established another objective to the NEAC dealing with IS. This committee should as well discuss issues of IS and provide to the minister advice accordingly. Since the members of NEAC is multi-sectoral and multidisciplinary in nature (members from ministries, academic and research institutions) hence fits very well to the issues of IS. The advice will be used at national level and in respective sectors through sector's invasive species committee.

It is proposed that at each sector ministry, there should be an *Invasive species committee* coordinated by sector environmental coordinator as established by EMA, 2004, that shall meet at least twice a year to look on status and publish the status of the invasive species in their sector. The sector's invasive species information should be published in the respective Ministries; relevant and affiliated institute websites upon approval of Permanent Secretary through advice from the Invasive Species Committee. The communication officers in the Ministry should publish or upload the information in their respective ministry websites, and whenever there is new threat respective ministry through Permanent Secretary upon advice from Invasive Species Committee shall offer press release on status, early warning and management options available to general public. The invasive species information to be published in the websites should include key information on distribution and abundance, life forms of such species and invasive characteristics; economic, environmental, and human health impacts, research and management techniques. Each sector should issue guideline of invasive species they have, and how to manage them. For cost effectiveness the online publication is suggested, but also simplified information may be printed for community. Also there should be a current list of all invasive species of respective sector and should be updated regularly.

In case of local government authority, it is evident that the environmental reporting structure as stipulated in Environmental Management Act 2004 is good, because there is establishment in the Act of committee at all levels; it is responsibilities of these committee to liaise with experts in relevant field within the district when there is suspicion of biological invasion in their areas. Therefore it is suggested that among other functions environmental officers and environmental committee at all level from Hamlet (Kitongoji) to regional level, should also

be responsible to manage invasive species, and share information to respective ministries and VPO.

2.6.3 Strengthening identification and management of IS in Tanzania

Determining the stages of invasion and management action may be challenging to some of the local communities in Tanzania. Due to low level of awareness on invasive species, some communities cannot identify invasive species at early stages of invasion. However, there exist standard approaches/frameworks on how IS can be managed successfully. For example according to the guideline issued by the Convention of Biological Diversity (CBD), it calls for “hierarchical approach” based on four stages of biological invasion. These approaches are;

(1) priority to be given to preventing the introduction of invasive alien species. This approach is generally far more cost-effective and environmentally desirable than measures taken after IS introduction and establishment. Prevention is normally done at national borders to avoid introduction of unwanted species into the country;

2) if prevention is not possible and the species have been introduced and is at early stage of establishment, early detection and rapid response (EDRR) should be carried out to prevent its wider establishment. The preferred EDRR response is often to eradicate the organisms as soon as possible. In the event that eradication is not feasible or resources are not available for its eradication, containment measures should be implemented. Eradication is more effective and lower in cost in the long run than permanent control of IS. Eradication is most effective if a new arrival is detected early while still in small numbers;

3) in the event that an IS has established across a wide range or localised containment is not feasible or resources are not available, long-term control measures be implemented; and

4) restoration and monitoring should be implemented to ensure success of the management program. Some species, habitats and ecosystems may be assisted to recover after an invasion.

For convenience, and to fit the local context, the NTF developed a quick guide to aid identification and management of IS in Tanzania. The guide is based on two criteria; extent of spread and negative impacts (Figure 6). However, research and practice have always given more weight to impact because there is little evidence to support that species with wide distribution also have high adverse impacts (Ricciardi and Cohen, 2007).

The extent of spread cannot always be used as a proxy for impact because IS may cause high negative impact locally, but they spread only slowly. Thus, a species causing high negative impacts but having low rate of spread should be prioritized for management than a species with a high rate of spread and a low negative impacts.

		Extent of Spread			
		Absent	Low	Medium	High
Negative impacts (current and potential)	High	Prevent introduction of undesired species	Eradicate, Restore and Monitor	Eradicate, Restore and Monitor	Control, Restore and Monitor
	Medium	Prevent introduction of undesired species	Eradicate	Eradicate, Restore and Monitor	Control, Restore and Monitor
	Low	Monitor/Prevent introduction of undesired species	Monitor	Eradicate	Control
	No recorded	Prevent introduction of undesired species	Monitor	Monitor	Monitor

Figure 6: A quick decision support tool to guide management actions against IS in Tanzania.

Important to note:

- *High impact refers to intolerable adverse effects caused by invasive species that have been established by scientific evidence and expert opinions. The effects may also include but not limited to reduction by 50% of agricultural productivity and displacement of any native species.*
- *Low impact refers to extremely localised impact to less than 0.05% of individuals in the population.*
- *High extent of spread refers both to high abundance and wide distribution of a particular species in a given region or protected area. A particular species has high extent of spread if it covers more than 10% of habitat it invades or recorded in high abundance in almost all regions of Tanzania.*
- *Low extent of spread refers to low distribution of a species not exceeding 500 m with a local abundance less than 1000 individuals whose age is half the lifespan, or a species found in less than 2 district of Tanzania whose spread is less than 100 m per day.*
- *Medium extent of spread refers to any levels of abundance and distribution in between low and high extent of spread.*
- *Medium adverse impact refers to any impact whose intensity is between the indicated low and high impact levels.*

2.6.4 Prioritisation of Invasive species for management

Resources for managing IS are limited which makes prioritization unavoidable. Through review of available literature and other reports it has shown that not all 220 invasive and potential invasive species identified cause similar impacts on the ecosystems and economic loss in the country. To identify which ones cause bigger impacts to the environment and economy, a ranking exercise was conducted during stakeholders' workshop to prioritise a list of IS that requires immediate action to be taken against their impacts to the development of the respective sector (Appendix 12 & 13). Three criteria were used to rank the species; 1) rate of spread, 2) abundance and 3) negative impacts to economy, health or environment. A species was ranked as highest priority if it scored highest among the others in one or more

of the criteria, the next score was given to the next lower rank. As a result of this exercise, ten most noxious species across all sectors were identified. The current known distribution of the 10 species is presented in Figure 7. The map shows the region in which the species is known to occur whereby each species is marked by a representative symbol. The species include;

- *Spodoptera frugiperda* (Fall armyworm),
- *Prosopis juliflora* (Prosopis),
- *Parthenium hysterophorus* (Carrot weed),
- *Astripomoea hyscamoides* (Kongwa weed),
- *Chromolaena odorata* (Siam weed, Amachabongo),
- *Gutenbergia cordifolia* (Gutenbergia),
- *Corvus splendens* (Indian house crow),
- *Caesalpinia decapitala* (Mauritius thorn),
- *Eichhornia crassipes* (Water hyacinth), and
- *Tuta absoluta* (Tomato leafminer).

Brief description of these species is provided in the next paragraph.

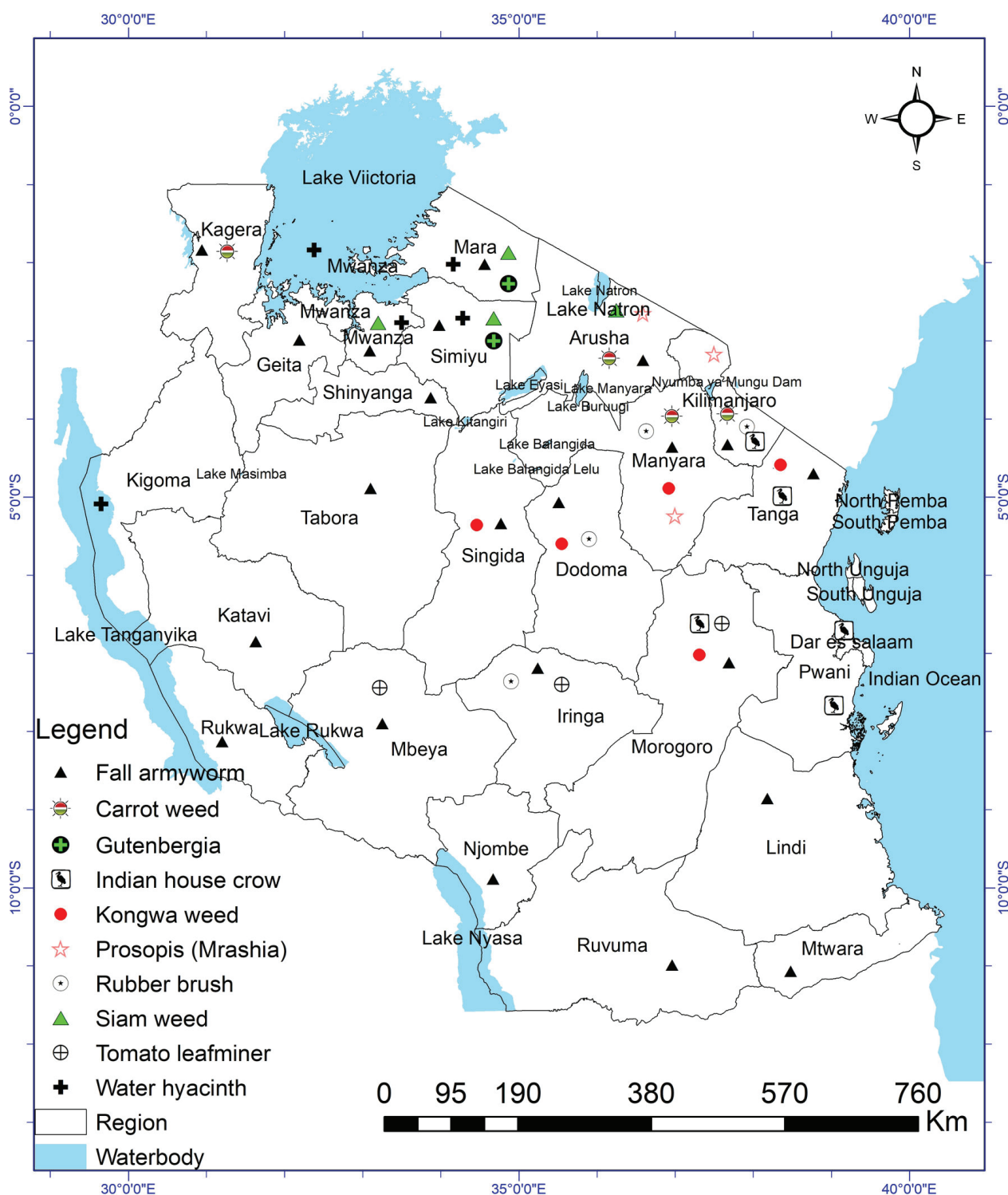


Figure 7. Distribution of ten priority invasive species in Tanzania (symbols indicate some of the areas where the species is known to occur). Source: Bukombe J and Mrosso H, 2019.

1. *Spodoptera frugiperda* (Fall armyworm)

Fall armyworm (FAW) is a species in the order Lepidoptera (Plate 1). It is a polyphagous pest that is native to tropical and subtropical regions of the Americas. It is endemic to the North and South American continents. The term “armyworm” can refer to several species,

often describing the large-scale invasive behavior of the species' larval stage. Larvae are a light green to dark brown with longitudinal stripes. The pest was first detected in Central and West Africa in 2016 and one year later had arrived to Tanzania. The moth has very strong flying ability, reaching up to 100 km/day. FAW has about 6-12 generations and can produce up to 2,000 eggs over its life span. The caterpillars of this moth feed on leaves, stems and reproductive parts (Pogue, 2002). In Tanzania, it prefers maize, millet, rice and sorghum but can feed on more than 80 additional species of cereals including bean, sunflower, coffee, cotton, and tobacco (Pogue, 2002).



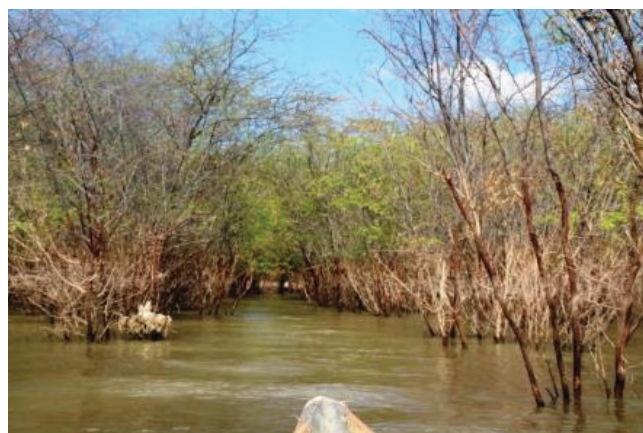
Plate 1: Fall armyworms infesting maize (Source: Mwinyimkuu H and Chidege M, 2018)

2. *Prosopis juliflora* (prosopis)

Prosopis juliflora is an evergreen, multi-stemmed shrub or small tree with an umbrella-like canopy (Plate 2). It can reach over 10 m in height, and the branches usually carry long thorns. The species origin is Latin America but has been introduced to many countries in Africa including: Ethiopia, Kenya, Sudan and South Africa. In Tanzania, *Prosopis* also known as *Mrashia* or *Mgunga taveta* was accidentally introduced from Kenya in 1988 by traders between Taveta and Moshi (Kilawe *et al.*, 2017). Currently, *Prosopis* has been recorded in nine districts, but the potential for further spread is significant.



(a)



(b)

Plate 2: Invasion of *Prosopis juliflora* in (a) Kahe and (b) Nyumba ya Mungu dam in Kilimanjaro, Tanzania (Source: Kilawe C, 2017)

3. *Parthenium hysterophorus* (Carrot weed)

Parthenium hysterophorus which is also called white top is a species of flowering plant in the family Asteraceae which is native to the American tropics (Plate 3). It has been introduced

to Asia, Australia, Pacific islands and Africa. The species grows fast and attains flowering within 3-4 weeks from germination while its flowering persists for 6-8 months in favourable conditions. It is estimated that each plant can produce up to 25,000 seeds with over long seed dormancy. In Tanzania, the species is commonly named as gugu karoti (or carrot weed).

The occurrence of *Parthenium hysterophorus* in the country was for the first time reported in 2010 (Clark and Lotter, 2011). The species is believed to be introduced from Kenya as patches of the species were firstly spotted along the Namanga Road from Arusha towards Kenya. Currently, the actual reported distribution of *Parthenium* have widened to four regions in the country including Arusha, Kagera, Mara, and Kilimanjaro. It is estimated that each plant can produce up to 25,000 seeds with over long seed dormancy.



Plate 3: Phenology of *Parthenium hysterophorus* (Carrot weed or white top) as seen in Arusha (Source: Bukombe J, 2016)

4. *Chromolaena odorata* (Siam weed)

Chromolaena odorata (Siam weed) is a perennial shrub in the sunflower family which is native to Central and Southern America (Plate 4). It is a rapidly growing perennial herb which is multi-stemmed shrub to 2.5 m (100 inches) tall in open areas. It has soft stems but the base of the shrub is woody. In shady areas it becomes etiolated and behaves as a creeper, growing on other vegetation. It can then grow up to 10 m (33 feet) tall.

Siam weed has a growth rate of 20 mm/day and can produce more than 8,700 seeds per plant per season (Sivagnanam and Swamy, 2010). The species has excellent dispersal mechanisms which include wind, water and can stick or attach to vehicles, machinery, clothing, footwear and animals.



Plate 4: Phenology of *Chromolaena odorata* (Source: Witt A and Mwilawa A, 2018)

5. *Tuta absoluta* (Tomato leaf miner)

Tuta absoluta is a species of moth in family Gelechiidae known by the common names Tomato leafminer (Plate 5). It is an insect pest native to South America. In Africa, it was firstly detected in Tunisia in 2008 (Abbes *et al.*, 2012), Sudan and Ethiopia in 2011 (Pfeiffer, 2013) and Kenya and Tanzania in 2014 (Chidege *et al.*, 2016). Tomato is the main host plant, but *T. absoluta* also attacks other crop plants of the family solanaceae, including potato, eggplant, pepino, pepper and tobacco. The larva feeds voraciously on tomato plants, producing large galleries in leaves, burrowing in stalks, and consuming apical buds and green and ripe fruits. It is capable of causing a yield loss of 100%. In Tanzania, the pest is known as “*Kanitangaze*” (literally means spread the news).

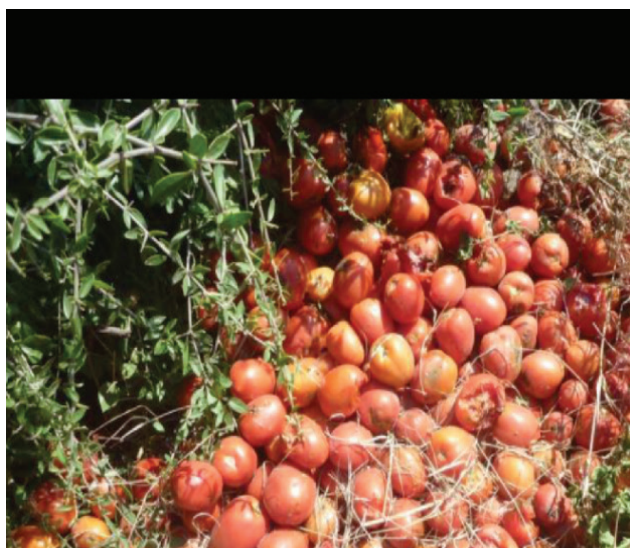


Plate 5: A pile of ripe tomatoes infested by Tomato leaf miner (Source: Chidege M, 2018)

6. *Astripomoea hyoscyamoides* (Kongwa weed)

Astripomoea hyoscyamoides is an annual or short-lived perennial plant covered with greyish hairs, reaching a height of 1.8 m with a potential to grow up to 2 m tall, with alternate simple leaves and showy, white and purple flower (Plate 6). The weed is recognized as “Mahata”

in vernacular. It is a weed that grows extensively in both crop and grazing land of semi-arid lands of Central Tanzania.



Plate 6: Phenology of *Astripomoea hyoscyamoides* (left) and site infested by Kongwa weed in Dodoma (right) (Source: Mwilawa A, 2018)

7. *Gutenbergia cordifolia* (Gutenbergia)

Gutenbergia cordifolia is an annual plant native to Africa (Plate 7). While in Kenya the plant has already been reported as an invasive weed in most farmlands (Anderson and Morales, 2005; Gharabadiyan *et al.*, 2012). In Tanzania the species seems to have invaded and dominated most protected areas of northern Tanzania including more than half of the World Heritage site Ngorongoro crater floor (250 km²) and most parts of the Serengeti ecosystem and Tarangire National Park, negatively affecting forage quantity and quality as well as the abundance and distribution of herbivores (both wildlife and livestock) in the invaded areas (Ngondya *et al.*, 2016). The consequences of this are large and cascade in nature including direct effect in tourism, livestock and agriculture sectors which are the backbone of the country's economy and livelihood of the people.



(a)



(b)

Plate 7: *Gutenbergia cordifolia* as shown during its flowering stage (a) and its invasion in most areas of Ngorongoro Crater (b) (Source: Ngondya I, 2018).

8. *Corvus splendens* (Indian house crow)

The house crow is a common bird of the crow family that originates in Asia (Plate 8). The species size is approximately 40 cm (16 in) in length but is slimmer than the jackdaw and the carrion crow. The forehead, crown, throat and upper breast are a richly glossed black, whilst the neck and breast are a lighter grey-brown in colour. The wings, tail and legs are black. There are regional variations in the thickness of the bill and the depth of colour in areas of the plumage. The house crow is now found in many parts of the world, where they arrived assisted by shipping.

The history of the Indian house crow in Tanzania dates back to the 1890s when it was deliberately introduced to Zanzibar to act as an urban garbage scavenger (Long, 1981). The species spread rapidly onto the mainland along the coast from Malindi in Kenya to Mtwara in Tanzania (Mackworth-Praed and Grant, 1960) and nowadays the species has spread into the whole coastal areas in the mainland of Tanzania, including neighboring countries of Kenya, Somalia and Ethiopia (Sinclair *et al.*, 1981; Shimba and Jonah, 2017). Recently, the specie has been recorded in Morogoro, Korogwe, Mikumi, Ifakara and Dodoma (Wium-Anderson and Reid, 2000) as well as in Nzega District (Tabora Region) (Ally Nkwabi Pers. comm., 2017).



Plate 8: Indian House Crow as seen in Muheza district in Tanga region (Source: Nkwabi A, 2017).

9. *Caesalpinia decapitala* (Mauritius thorn)

Caesalpinia decapitala is a thorny, woody, clambering shrub with bipinnate leaves and clusters of pale yellow flowers (Plate 9). It has large, globular seeds which are produced in flattened, unsegmented, beaked pods. The origin of Mauritius thorn is unclear but its common name suggests, its native range might include Indonesia and Malesia (including the indo-Malaysian archipelago and northern Australasia). The species was apparently originally introduced to Tanzania as a hedge plant.



Plate 9: A Mauritius thorn as seen in Arusha National Park (Source: Ng'umbi G, 2018)

10. *Eichhornia crassipes* (Water hyacinth)

The common Water hyacinth is a free-floating perennial aquatic plant (or hydrophyte) native to tropical and sub-tropical South America (Plate 10). With broad, thick, glossy, ovate leaves, water hyacinth may rise above the surface of the water as much as 1 meter in height. The leaves are 10–20 cm across on a stem which is floating by means of buoyant bulb like nodules at its base above the water surface. They have long, spongy and bulbous stalks. Water hyacinth is often a highly invasive species outside its native range. The species has become an invasive plant species on Lake Victoria and some rivers such as the Ugalla River in East Africa after it was introduced into the area in the 1980s.



(a)



(b)

Plate 10: Spreading Water hyacinth in the Ugalla River (a) and Lake Victoria (b) (Source: Bukombe J, 2011 and Mbwambo J, 2018).

2.6.5 Roles and Responsibilities

Although, invasive species management is a shared responsibility involving people and organization from local to national scale, the overall coordination to fulfill the requirements of the NISSAP is placed under the Vice President Office. The VPO will ensure that all stakeholders undertake their responsibilities in invasive management activities. The Strategy recognizes that roles and responsibilities vary across the invasion stages and there can also

be differences between jurisdiction and landscapes, that is why the NISSAP highlight roles and responsibilities of impacted Ministries, Departments and Local authorities.

For example, during importation of seeds, the Head of Plant Health and Biosecurity under the MAFSC is accountable to ensure that the consignment are inspected to identify any risks that they may carry and their destination determined for easy tracking and evaluation. For existing species in agricultural and reserved area, the officers in charge of the area are accountable to control and report on the progress. These should work hand in hand with the communities through their local government authorities.

For simplicity and clarity some of the responsibilities are spelled out clearly as follows:

Vice President Office

- coordinate, facilitate and promote national IS management guidelines and programs
- provide leadership and coordination for emergency responses to new incursions of national significance
- use the NEAC to evaluate progress of the NISSAP

Ministry of Natural Resources and Tourism

- Coordinating and implementing forest and catchment-based IS management plans for existing and already identifies IS.
- Reserve managers under MNRT, should monitor IS impacts and carry out surveillance for detecting high risk IS that pose risks to their reserves or could spread to other regions
- Build public awareness and knowledge of invasive species of national significance in the sector.

Ministry of Agriculture Food Security and Cooperative

- Provide a legislative framework, especially biosecurity legislations, to minimize the risk pre-border and at the border of invasive species incursions including undertaking enforcement actions and regulatory interventions.

Ministry of Livestock and Fisheries

- Enforce guidelines and regulations requiring proper management of grazing lands
- contribute to research and development programs to improve weed management best practice for different agricultural and natural systems, as appropriate
- Enforce guidelines and regulations requiring proper management of beach unit and cage fishing.

Local Government Authorities

- Lead and coordinate emergency responses to priority IS incursions at local levels and take all reasonable steps to eradicate district and regional IS.
- For containment of an established invasive species, work with bordering local authorities to apply guidelines on transport of plant or animal materials with the risks to introduce invasive species.
- Undertake enforcement actions and regulatory interventions with respect to individual landholders to support sustained management of widely established IS.

- Support the activities of local groups undertaking IS management

Ministry of Education and Vocational Training

- support and build public awareness about IS issues
- support the collection and collation of national IS data and information
- support mainstreaming IS modules from primary to higher learning institutions

3.0 NATIONAL INVASIVE SPECIES STRATEGY AND ACTION PLAN (NISSAP)

3.1 Vision

Tanzania's citizens, ecosystems and resources are secured from invasive species and their negative impacts.

3.2 Mission

To reduce negative impacts of invasive species by establishing efficient and effective legal and institution framework; communication, education and public awareness system and technologies for prevention, eradication and control of the species.

3.3 Goal

Tanzania's biodiversity, ecosystem services and livelihood assets are protected from invasive species and their negative impacts.

3.4 Scope

This Strategy provides guidance for the management of IS in Tanzania. The scope of this Strategy includes terrestrial and aquatic (freshwater and marine) ecosystems; and invasive plants, animals, microbes (including bacteria), and fungi that have the potential to pose undesirable or detrimental impacts on humans, animals, ecosystems, or the economy. The Strategy will operate for 10 years effectively from 2019/2020.

3.5 Strategic objectives, targets and actions

The Strategy identifies six Strategic Objectives that can be used to achieve its Vision. These Strategic Objectives will act as guiding statements towards implementing the Strategy and they are expected to be adopted and implemented by every responsible sectors as indicated and guided by the IS communication and coordination framework. There will be some flexibility around this during the implementation of the actions on the ground and this will depend on how each respective sector/institution is playing its role in dealing with the IS as per these stated objectives. Also, responsible sectors/ministry should try and use these guiding statements to build on long-lasting strategies as the new information and lessons come to light to enable improving on long-term solutions to addressing the problem of IS.

Various Targets have been identified for each Strategic Objective as shown below:

OBJECTIVE 1: PREVENT INTRODUCTION AND SPREAD OF NEW INVASIVE SPECIES

Experience from elsewhere in the world shows that, prevention of invasive species is by far more cost-effective and environmentally desirable management practice when compared to measures taken after introductions of the species. Field survey done by the NTF found that in Tanzania so far the management of invasive species was mainly through control practices. Prevention and early detection and rapid responses (EDRR) are not given adequate attention. Other challenges observed include; unregulated pathways for introduction of IS; weak phytosanitary systems; inadequate control of people and livestock movement across the border; and inadequate control of services and goods movement across the border.

Managing these challenges, with the goal of stopping new species from entering Tanzania and becoming established, is a cornerstone to effective invasive species management.

Target 1.1: At least 90% of all biological materials introduced to Tanzania are inspected against IS threats by 2024

Effective inspection of invasive species entering Tanzania requires knowledge of ways in which the species enter the country, risk assessment of potential invasive species across the national boarder and good capacity of the regulating agencies to be able to conduct the risk assessment and enforcement of regulations.

Action 1.1.1: Identify and manage priority pathways and vectors of IS introduction and spread

At the country level, there is great need to conduct an in-depth analysis of pathways for managing invasive species. As has been explained in section 2.2, an analysis of invasive species pathways and vectors of introduction and spread is important in order to provide information that will guide the choice of appropriate intervention. This will involve working with national and international agencies to ensure that mandatory inspections for vectors such as movement of animals, all-terrain vehicles, boats, ballast water and other modes of transportation are implemented through regulatory tools.

At the country level, there is great need to conduct an in-depth analysis of pathways for managing invasive species. As has been shown in section 2.2, five of the total six different pathways (escape, transport contaminant, transport stowaway, corridors and release) are important and need consideration during the implementation of this Strategy. As the pathways affect nearly all sectors, there is need for each sector to obtain an indepth analysis of the specific pathways that affect the specific sector. This analysis will help to provide information that will guide the choice of an appropriate intervention approach. It will also help identifying sectoral linkages among pathways, and thus designing feasible strategies of management. This will involve working with national and international agencies to ensure that mandatory inspections for vectors such as movement of animals, all-terrain vehicles, boats, ballast water and other modes of transportation are implemented through regulatory tools.

Action 1.1.2: Conduct risk assessment of potential IS

Developing early warning system is important in order to help determine which invasive species are most likely to enter Tanzania and become established. Risk assessment must be conducted holistically and it should consider pathways of introduction and vectors of spread.

Action 1.1.3: Strengthen and Enforce regulations dealing with importation and movement of live materials at national and regional/international borders

Strengthening and enforcing regulations dealing with importation and movements of lives materials helps to prevent potentials of introductions and spread of invasive species in the country.

Action 1.1.4: Capacitate border posts with adequate resources to manage invasive species

To prevent entrance of invasive species or goods that are subject to restriction, it is necessary that border posts are capacitated with necessary resources for effective management of invasive species.

Target 1.2: At least 95 % of emerging IS are detected and eradicated by 2029

Detection and eradication of emerging invasions is a recommended management practice when prevention is not effective. The practice increases the likelihoods that small and localised invasions are eradicated at an early stage. In Tanzania, effective detection and

eradication of new invasions require to have in place a framework for co-ordination and communication on invasive species, surveillance system to identify the species and EDRR procedures to be followed once the invasions are identified. Given low level of awareness on invasive species among the general public, a list of potential invasive species should be prepared and disseminated.

Action 1.2.1: Develop and implement EDRR procedures for IS management

Early detection and rapid response to new invasions are key to successfully address new invasions and minimize management costs. EDRR procedures will be based on the development of an action plan that clearly identifies key organizations, groups, and agencies that should be involved; roles and responsibilities; communication networks; species identification and reporting systems; risk assessments; treatment options; and monitoring plans. The EDRR plan will enable and support action across all jurisdictions.

Action 1.2.2: Develop and implement a national surveillance system for managing IS

A national surveillance system that will survey the existing but unknown and detect emerging invasive species across the country should be developed. The surveillance teams should be empowered with necessary resources and facilities including technology, equipment, transportation and reporting system.

Action 1.2.3: Develop and disseminate invasive species “watch lists”

A list of potential invasive species should be prepared and disseminated in order to alert the public about a new invasion or new behaviour of existing invasive species for enhancing their participation in invasive species management.

OBJECTIVE 2: REDUCE NEGATIVE IMPACTS OF EXISTING PRIORITY INVASIVE SPECIES

Priority invasive species are those with high rate of spread and impacts as shown in Fig.7. Local abundance and spread of established IS can be reduced through implementation of control practices. Field survey by the NTF found that mechanical control practices which are costly and less effective were the most commonly used in Tanzania (Table 7). Chemical and biological control practices are more effective in control of established invasive species but their use was constrained by long bureaucratic approval procedures. Control of IS by utilization received high community interest and political will but there was no sufficient research conducted on the sustainability of this practice. It was also found that in areas where control was conducted, there was inadequate restoration and monitoring. Restoration accelerates ecosystem recovery with respect to its health, integrity, resistance to disturbance and resilience. By monitoring, we can gather baseline data that will help determine short and long-term trends, as well as make comparisons against standards or targets.

Target 2.1: The abundance and spread of all national priority invasive species are reduced by at least 50% by 2029

In order to reduce local abundance and spread of established invasive species in Tanzania, it is important that the species are identified, mapped and quantified. Locally tested and accepted control practices including but not limited to biological, chemical, nature-based and integrated approaches should be developed and promoted. Technical know-how from other countries (e.g. Australia and South Africa) should be established and used but this should go hand in hand with mainstreaming of traditional knowledge and innovations. Research on control of IS by utilization should be conducted to resolve existing concern on sustainability of control by utilization of IS.

Action 2.1.1: Identify, map and reduce abundance of IS in their established and invasion areas

Established invasive species should be identified, quantified, and mapped in order to determine effective control measures

Action 2.1.2: Building on the management know-how from within and other countries

Traditional knowledge, innovation and other practices relevant for management of invasive species should be established, replicated, extended and mainstreamed into scientific knowledge for management of invasive species. Technical know-how from other countries (e.g. Australia and South Africa) should be established and used.

Action 2.1.3: Develop and promote integrated approaches to control IS.

Not all species can be managed using one method and sometimes approaches foreign to local environment have been rather more problematic and ineffective. Therefore, it is recommended to use nature-based (established and/or customized to local environment) and integrated management practices for effective invasive species management.

Action 2.1.4: Develop and strengthen a centralized national IS database

Developing and strengthening a centralized database on biodiversity including invasive species is very important. Such database can be used as a forum to record and track invasive species occurrences and management efforts across the country. The database can also be used for sharing data and provide opportunities for identification of gaps and hence funding sources for addressing such gaps in invasive species management.

Target 2.2: At least 50% of critical ecosystems impacted by invasive species are restored by 2029

Critical areas and habitats include water catchment forests, national parks, wetlands, nature reserves and pasture land. Restoration is designed to reinstate ecosystem functions and services, and to prevent the opportunity for future invasive species establishment. Habitat (Ecosystem) management may be required to avoid repeated degradation of restored ecosystems. Restoration techniques should be employed in a participatory approach to rehabilitate the habitats and areas impacted by invasive species.

Action 2.2.1: Integrate restoration actions in all invasive species management approaches

Restoration actions and approaches will facilitate the regeneration of natural habitats, sceneries, ecosystem functions and process to support biodiversity conservation and socio-economic development activities.

Action 2.2.2: Develop and implement framework for restoration of areas degraded by IS

A framework for restoration that can be used by invasive species stakeholders will be developed. The components of the guideline should include an explanation of the problem, and the goals and objectives, planned activities, and post-restoration monitoring and evaluation.

Action 2.2.3: Build and strengthen community capacity to conduct restoration of degraded ecosystems

Available resources will be identified and shared to strengthen and support restoration efforts. Such resources include but not limited to seeding, seedling, technical knowledge and land management practices.

Target 2.3: At least 50% invasive species management efforts are monitored and evaluated by 2029

In areas where eradication or control of invasive species was conducted and restoration done, monitoring should be carried out in order to determine effectiveness. Monitoring invasive species management efforts will reveal short- and long-term trends that can lead to new knowledge and understanding, and subsequently improve management effectiveness and efficiencies.

Action 2.3.1: Develop and implement a national invasive species management monitoring and evaluation framework

There is a need to develop a framework for monitoring and evaluation of invasive species in Tanzania. Development of this framework should be built upon existing invasive species management monitoring and evaluation tools and work towards answering key invasive species management questions.

Action 2.3.2: Improve existing monitoring standards and protocols for managing IS

The information accrued from monitoring and evaluation will be used to improve existing M & E standards and protocols so that data collected are useful for determining the effectiveness of invasive species control methods.

OBJECTIVE 3: ENHANCE NATIONAL CAPACITY TO MANAGE AND RESEARCH ON INVASIVE SPECIES

Sustainable management of invasive species depends on the national capacity on human resources, technology, infrastructure, knowledge and funding. Inadequate capacity to detect and implement management measures, financial resources, specialists in invasive species, research and monitoring were identified as impediments in the management of invasive species. Adequate, stable, long-term investments in the national capacity will reduce negative impacts and increase efficiency in managing invasive species.

Target 3.1: At least 70% of fund proposed for management of invasive species is secured and implemented by 2024

Adequate, stable, long-term funding is essential for effective and successful invasive species prevention and control in Tanzania. As described earlier in this strategy, the benefit-cost ratio of preventing infestations or addressing them as soon as possible is significant when compared with allowing an infestation to establish and spread. In short: prevention and early control pay back far more than they cost. Funding is a critical aspect of this invasive species management Strategy, and adequate, stable funding levels must cross fiscal years, and be flexible and accessible.

Action 3.1.1: Leverage funds to address invasive species management

Funds generated for management can often be applied more effectively across the land base if all resource concerns are being addressed in an integrated fashion. Therefore, opportunities to leverage funds addressing similar management objectives shall be sought, including, but not limited to, species at risk, habitat restoration, education, and research.

Action 3.1.2: Develop fund allocation guidelines for managing invasive species

The fund allocation guidelines should include: (i) summary of current baseline investments for invasive species management in Tanzania, including financial investment, staff and in-kind contributions; (ii) targets for both critical-level (minimum) programs that prevent invasive species impacts from becoming worse, and full-level (desired) programs that, in addition, reduce the impacts of existing invasive species populations; and (iii) propose mechanisms

for obtaining additional funds for management of invasive species.

Action 3.1.3: Establish an emergency response funding model for managing IS

An emergency response funding model should be established to ensure funds are readily available for immediate response to new invaders.

Target 3.2: By 2025, research on invasive species increased by 50%

Management of invasive species is heavily based on scientific knowledge of species biology, habitats, control methods, and other aspects of their natural history. Future research efforts should expand existing knowledge and incorporate the needs of stakeholders.

Action 3.2.1: Support research on priority invasive species and areas

Facilitation should be made possible for carrying out of research on prioritized species and areas to better understand invasive species and their impacts on human health, the environment and ecosystems, and local and national economies, and use this information to facilitate setting management priorities among species or geographic locations. Some preliminary areas this Strategy has identified that require better understanding and additional research include but not limited to:

- i. Impacts of invasive species on biodiversity, ecosystem services, economy and on human health;
- ii. Map and predict their potential and actual distribution;
- iii. Effects of climate change on invasive species introductions and distribution;
- iv. Effects of invasive species on species at risk (rare, endangered, threatened, vulnerable);
- v. Restoration techniques;
- vi. Control by nature-based management approaches of invasive species;
- vii. Investigate on long-term cost of doing nothing, and
- viii. Invasive species and ecosystem services.

Action 3.2.2: Mainstream invasive species management into existing research agenda of academic, research and development institutions

In order to provide a shared vision on the collective needs and priorities for invasive species research in Tanzania, there is need to mainstream invasive species management into existing research agenda in academic, research and development institutions in Tanzania.

Action 3.2.3: Strengthen National Environment Trust Funds for funding Research on Invasive species

Availability of research funds is key in ensuring that researches are conducted in the field of invasive species.

OBJECTIVE 4: ENHANCE STAKEHOLDER'S EDUCATION AWARENESS AND PARTICIPATION ON MANAGEMENT OF IS

Low level of education, public awareness, inadequate extension services and poor participation of stakeholders were identified as obstacles to successful management of invasive species. Therefore, deliberate actions should be strategized to ensure stakeholders

are effectively involved and participate in the management of invasive species.

Target 4.1: At least 50% of stakeholders are aware of various invasive species management options by 2024

Stakeholders' awareness on introduction, spread, negative impacts and control measures is important for effective management of invasive species. Community education and awareness is key to successful invasive species management. There is need to appropriately design, package and disseminate information for community education and awareness in the management of invasive species.

Action 4.1.1: Develop and implement community educational and awareness programs on invasive species management

Community education and awareness is key to successful invasive species management. There is need to appropriately design, package and disseminate information for community education and awareness in the management of invasive species.

Action 4.1.2: Promote behavioural change to mitigate introduction and spread of invasive species

Behavioural change is critical for effective invasive species management. Traditional approaches to education and awareness have demonstrated that, while people's understanding of an issue may increase, this does not always translate into changes in their behaviour or actions. Therefore, promoting actions that aim directly at changing people's behaviour is important for management of invasive species in Tanzania.

Action 4.1.3: Mainstream invasive species modules from primary to higher learning institutions

A cadre of trained professionals is needed for effective implementation of invasive species management strategies. Introducing invasive species modules in primary education, academic and training institutions will help build capacity for invasive species management in Tanzania.

Action 4.1.4: Strengthen technical capacity of Extension Service Providers on IS management

Disseminating the management options to wide numbers of smallholder farmers will require working through existing structures and leveraging opportunities that exist to reach large numbers of smallholder farmers from district to village levels. Local government entities have the closest regular contact with the farmers hence the need to build their capacity in managing IS that found in their areas. Agricultural Advisers and Extension Officers will conduct training and village rallies in their villages. They will be equipped with posters, leaflets, brochures, training manual and other training materials to effectively undertake their functions. Village authorities and opinion leaders will help mobilize communities to develop community management plans.

Target 4.2: At least 50% of all stakeholders participated in managing invasive species by 2024

Participation of stakeholders is vital at all levels of invasive species management from prevention, introduction, eradication, control and restoration. Therefore, actions that aim at promoting stakeholder's participation in invasive species management are needed.

Action 4.2.1: Mainstream invasive species management into national communication strategy

A National Communication Strategy (2015-2019) on environmental sustainability, growth and poverty reduction has been developed. The Strategy does not capture invasive species

management. Mainstreaming invasive species in the Strategy during its review will enhance community education, awareness and participation in management of invasive species in Tanzania.

Action 4.2.2: Recognize and award exemplary performance in invasive species management

Formally recognizing positive actions and behaviours motivates people, by setting good examples, demonstrating leadership, hence improving stewardship in invasive species management. Actions that are geared towards enhancing stakeholder's participation such as incentives in invasive species management are needed.

Action 4.2.3: Incorporate invasive species management actions in national and international environmental events

National and international environment events such as National Tree Planting day and World Environment Day should be used as platform for raising awareness and seeking stakeholder's participation in prevention, control, eradication of invasive species and restoration of affected ecosystems and sites.

Action 4.2.4: Create consistent and timely messaging platforms on invasive species management

It is important to create consistent and timely messaging platforms about invasive species management for all stakeholders in Tanzania. In order to reach wide audience, websites and smart phone apps should be developed to enable identification, reporting and management.

OBJECTIVE 5: MAINSTREAMING INVASIVE SPECIES MANAGEMENT INTO REGULATORY TOOLS

Policy and legislations are important guiding and regulatory tools for effective management of IS. One of the biggest impediments towards management of invasive species in Tanzania is inadequate mainstreaming and harmonization of invasive species management in policy and enforcement of regulatory tools. Therefore, the Strategy highlights the importance of mainstreaming and harmonization of invasive species into existing sectoral policies and legislations, establishing regulatory and enforcing regulatory tools, in order to facilitate management of invasive species impacted areas.

Target 5.1: At least 50% of all regulatory tools in Tanzania are revised and operationalized by 2022

Regulatory tools are mandatory to guide management of invasive species and must be reviewed, prepared and operationalized.

Action 5.1.1: Review and mainstream IS management into regulatory tools

It is of paramount importance to ensure that relevant regulatory tools are revised and mainstream invasive species.

Action 5.1.2: Harmonize conflicting regulatory tools for managing IS

Effective management of invasive species requires harmonisation of regulatory tools across all sectors. It is important to ensure that any conflicts in these regulations are harmonized in order to promote cross-sectorial operations among sectoral ministries and other stakeholders.

Action 5.1.3: Mainstream IS issues into local charters, sectorial ministries, local government and private sector plans and guidelines

Effective management of invasive species requires that all relevant stakeholders and

sectors are fully involved. In this case mainstreaming invasive species issues into local charters, sectoral and local government plans as well as those of other stakeholders is key to successful management.

Target 5.2: All existing regulatory tools and bodies dealing with invasive species management are enforced effectively by 2020

In order to ensure effective management of invasive species, all eight regulatory tools which address issues of invasive species (1 National Policy, 5 National Acts and 2 National Regulations – Appendix 4) should be enforced.

Action 5.2.1: Identify and capacitate agencies responsible for enforcement of regulatory tools on IS

It is important to identify and capacitate the agencies responsible for enforcement and ensure that they are actively enforcing the legislation. Enforcement of regulatory tools should promote voluntary compliance over legal action.

Action 5.2.2: Develop risk assessment process for effective enforcement of regulatory tools

It is important to conduct risk assessment on the regulatory tools to check if they are effective in the management of IS.

Action 5.2.3: Define roles and responsibilities of all agencies responsible for regulating IS

Roles and responsibilities for all organizations, groups, agencies, and individuals involved in invasive species management in Tanzania should be established for effective management of invasive species. For example, the roles for selection of trees for afforestation, seed regulation and seed importation should be clearly defined.

OBJECTIVE 6: STRENGTHEN AND PROMOTE STRONG COLLABORATION AND CO-ORDINATION WITH RELEVANT STAKEHOLDERS ON MANAGEMENT OF INVASIVE SPECIES

Lack of communication and coordination framework was identified among the constraints hindering effective management of invasive species in the country. Given that most stakeholders from within and outside the country are affected by invasive species, it is important to have a mechanism that will ensure effective collaboration and coordination for management of invasive species.

Target 6.1: By 2025, collaboration and coordination on management of IS among stakeholders increased by at least 50%

Strong collaboration and coordination require bringing together all organizations, agencies, groups, and individuals involved in invasive species management in Tanzania and beyond, and working together towards shared goals. This includes supporting current partnerships and fostering new ones, and building cross-jurisdictional collaboration.

Action 6.1.1: Strengthen trans-boundary partnerships on management of IS

There is need to strengthen partnerships with bordering national jurisdictions to encourage management efficiencies, and promote mutual understanding and support for the management of invasive species.

Action 6.1.2: Establish coordination and communication mechanism for effective management of IS to all relevant stakeholders

Given the many stakeholders from within and outside the country are affected by invasive species, it is important to have a mechanism that will ensure effective collaboration and

coordination for management of invasive species.

Target 6.2: By 2025, collaboration and co-ordination on the management of IS among stakeholders promoted by at least 50%

One of the setbacks to the current practice in management of invasive species is poor collaboration and co-ordination across sectors. Strong collaboration and coordination are important factors contributing to effective management of invasive species.

Action 6.2.1: Develop and implement an effective system for collaboration and coordination on IS management among stakeholders

In order to have multi-sectorial coordination, developing and implementing a system for coordination is important for achieving a common goal in managing invasive species. A mechanism for sharing best practices for managing invasive species should be developed and implemented.

Action 6.2.2: Monitor and evaluate cross-sectorial coordination and collaboration on the IS management

In order to ensure effective management of invasive species, monitoring, evaluation of coordination and collaboration between sectors should be conducted.

Action 6.2.3: Develop and implement a framework for quarterly reporting on IS issues

In order to ensure that all stakeholders are effectively implementing the Strategy, quarterly reports shall be prepared and submitted to the responsible entity as shown in Figure 5.

3.6 Action Plan

This Action Plan consists of actions to be implemented at national level in order to achieve the Strategic Objectives and Targets. The Plan has been formulated and is again open for improvement by each responsible players and actors who should try to relate this with the real observations they find on the ground. While logical consideration was taken into account in linking this framework with the Strategic Objectives, it should be understood that the adoption and operationalization of this are assumed not to be uniform but rather case by case, depending on the situation of each of the actors. Hence, this Plan needs to be used with modifications of the observed situation during the course of implementation. Furthermore, monitoring and evaluation of this Matrix is expected to have some flexibility when some of the assumptions used are critically evaluated and consolidated using the real situation as it occurs on the ground.

Table 12: Logical Framework Matrix

TARGET	ACTION	RESPONSIBILITY	TIMEFRAME	INDICATORS
OBJECTIVE 1: PREVENT INTRODUCTION AND SPREAD OF NEW INVASIVE SPECIES				
1.1: At least 90% of all biological materials introduced to Tanzania are inspected against IS threats by 2024	1.1.1: Identify and manage priority pathways and vectors of IS introduction and spread	Research and academic institutions, Ministry responsible for Environment, Wildlife, Water, Transport, Works, Agriculture, Forestry, Livestock, and Tourism	By 2024	Pathways and vectors of introduction of invasive species to Tanzania are identified and managed
	1.1.2: Conduct risk assessment of potential IS	Ministry responsible for Environment, Agriculture	By 2022	Risk assessment protocols in place and operational New invasive species are not introduced to Tanzania
	1.1.3 Strengthen and Enforce regulations dealing with importation and movement of live materials at national and regional/ international borders	Ministry responsible for Environment, Immigration, Transport, Wildlife, Forestry, Agriculture, Fisheries, Livestock & Development partners, Research and academic institutions, NEMC	By 2022	Decrease in the rate of introduction of new invasive species to Tanzania Increase in compliance to rules and regulations underlying introduction/ movement of biological materials Successful prosecutions of offenders
	1.1.4: Capacitate border posts with adequate resources to manage invasive species	Ministry responsible for Environment, Immigration, Transport, Wildlife, Forestry, Agriculture, Fisheries, Livestock, Finance & Development partners	By 2024	Decrease in the rate of introduction of new invasive species to Tanzania Sophisticated equipment for identification of biological materials in place and operational

TARGET	ACTION	RESPONSIBILITY	TIMEFRAME	INDICATORS
1.2: <i>At least 95 % of emerging invasive species are detected and eradicated by 2029</i>	1.2.1: Develop and implement EDRR procedures for IS management	Ministry responsible for Industries, Transport, Local Government, Immigration, Deep sea, NEMC, Academic and Research Institutions, Private Sector, NGOs and CBOs and relevant stakeholders	By 2019	Emergency response procedures and plans in place Invasive species spread to new areas is minimised.
	1.2.2: Develop and implement a national surveillance system for IS management	Ministry responsible for Environment, Agriculture, Fisheries, Forestry, Livestock, Mining, Infrastructure, Industries, Transport, Local Government, Immigration, Deep sea, NEMC, Academic and Research Institutions, Private Sector, NGOs and CBOs and relevant stakeholders	By 2021	National surveillance system in place and operational Invasive species are detected at early stage of invasion and addressed
	1.2.3: <i>Develop and disseminate invasive species "watch lists"</i>	Ministries responsible for Environment, Forest, Wildlife, Tourism, Agriculture, Water, Livestock and Fisheries, Works, Transport and Communication, Health, Community Development, Gender, Elderly and Children, Lands, Housing and Human Settlement Development, Industries & Trade, Education, Science, Technology and Vocational Training, Finance and Planning, Deep sea, Immigration, and Academic and research institutions, LGAs, Private sectors, NGOs, CBOs, Research and academic institutions & Development partners	By 2020	Species "watch list" in place and operational

TARGET	ACTION	RESPONSIBILITY	TIMEFRAME	INDICATORS
OBJECTIVE 2: REDUCE NEGATIVE IMPACTS OF EXISTING PRIORITY INVASIVE SPECIES				
2.1: The abundance and spread of all national priority invasive species are reduced by at least 50% by 2029	2.1.1: Identify, map and reduce abundance of invasive species in their established and invaded areas	Ministry responsible for Water, Environment, Wildlife, Fisheries, Agriculture, Forestry, Livestock and Local Government, Research Institutions, NGOs, CBOs	By 2020	Decrease in area occupied by priority listed invasive species Information on priority species distribution and abundance is available
	2.1.2: Building on the management know-how from within and other countries	Ministry responsible for Water, Environment, Wildlife, Fisheries, Agriculture, Forestry, Livestock and Local Government, Research Institutions, NGOs, CBOs	2024	Best practice for invasive species management is adopted The impacts of invasive species are reduced through improved management practices
	2.1.3: Develop and promote integrated approaches to control IS.	Ministry responsible for Water, Environment, Wildlife, Fisheries, Agriculture, Forestry, Livestock and Local Government, Research Institutions, NGOs, CBOs	By 2019	Appropriate approaches are adopted for management of invasive species
	2.1.4: Develop and strengthen a centralized national IS database	Ministry responsible for Environment, Wildlife, Fisheries, Forestry, COSTECH, Research and Academic Institutions, Private sector, NGOs and CBOs	By 2019	A functional national platform in place Number of information products adopted by policy makers Number of active websites, portals and database

TARGET	ACTION	RESPONSIBILITY	TIMEFRAME	INDICATORS
2.2: At least 50% of critical ecosystems impacted by invasive species are restored by 2029	2.2.1: Integrate restoration actions in all IS management approaches	Ministry responsible for Forestry, Fisheries, Environment, Local Government, Private Sector, NGOs and CBOs, Research and academic Institution	By 2019	Proportion of area invaded by invasive species under active management
	2.2.2: Develop and implement a framework for restoration of degraded areas by IS	Ministry responsible for Forestry, Fisheries, Environment, Local Government, Private Sector, NGOs and CBOs, Research and academic Institution	By 2029	Framework in place and operational
	2.2.3: Build and strengthen community capacity to conduct restoration of degraded ecosystems	Sector Ministries; Academic and Research Institutions, Development partners, NGOs and CBOs	By 2020	Communities actively protect their assets and values.
2.3: At least 50% invasive species management efforts are monitored and evaluated by 2029	2.3.1: Develop and implement a national IS management monitoring and evaluation framework	Ministry responsible for Environment	2023	Effectiveness of current restoration program is known Restoration guidelines are reviewed.
	2.3.2: Improve existing monitoring standards and protocols for IS management	Ministry responsible for Environment	2020	Existing protocols reviewed and updated

TARGET	ACTION	RESPONSIBILITY	TIMEFRAME	INDICATORS
OBJECTIVE 3. ENHANCE NATIONAL CAPACITY TO MANAGE AND RESEARCH ON INVASIVE SPECIES				
3.1: At least 70% of funds proposed for management of invasive species is secured and implemented by 2024	3.1.1: Leverage funds to address invasive species management	Ministries responsible for Environment, Forest, Wildlife, Tourism, Agriculture, Water, Livestock and Fisheries, Works, Transport and Communication, Health, Community Development, Gender, Elderly and Children, Lands, Housing and Human Settlement Development, Industries & Trade, Education, Science, Technology and Vocational Training, Finance and Planning, Deep sea, Immigration, and Academic and research institutions, LGAs, Private sectors, NGOs, CBOs, Development partners	By 2024	Increase in funding available for management of invasive species
	3.1.2: Develop fund allocation guidelines for managing IS	Ministries responsible for Environment, Forest, Wildlife, Tourism, Agriculture, Water, Livestock and Fisheries, Works, Transport and Communication, Health, Community Development, Gender, Elderly and Children, Lands, Housing and Human Settlement Development, Industries & Trade, Education, Science, Technology and Vocational Training, Finance and Planning, Deep sea, Immigration, and Academic and research institutions, LGAs, Private sectors, NGOs, CBOs and development partners	By 2024	Funding allocated to relevant research projects and or institutions

TARGET	ACTION	RESPONSIBILITY	TIMEFRAME	INDICATORS
	3.1.3: Establish an emergency response funding model for managing IS	Ministries responsible for Environment, Forest, Wildlife, Tourism, Agriculture, Water, Livestock and Fisheries, Works, Transport and Communication, Health, Community Development, Gender, Elderly and Children, Lands, Housing and Human Settlement Development, Industries & Trade, Education, Science, Technology and Vocational Training, Finance and Planning, Deep sea, Immigration.	By 2024	Emergency response on new invasions implemented
3.2: By 2025, research on invasive species increased by 50%	3.2.1: Support research on priority invasive species and areas	Ministry responsible for Environment, Research and academic institutions , Private sectors, NGOs, Development partners, Academic and research institutions, LGAs, Private sectors, NGOs, CBOs, NEMC	By 2024	Research on invasive species is undertaken based on priority needs Investment in invasive species research increases.
	3.2.2: Mainstream IS management into existing research agenda of academic, research and development institutions	Ministries responsible for Education, Science and Technology, Vocational Training, Academic and research institutions, Teacher's training Colleges	By 2024	Increase in the numbers of appropriately-trained people (at tertiary or post-graduate levels) involved in the management of invasive species

TARGET	ACTION	RESPONSIBILITY	TIMEFRAME	INDICATORS
	3.2.3: <i>Strengthen National Environment Trust Funds for funding Research on Invasive species</i>	Ministries responsible for Environment, Forest, Wildlife, Tourism, Agriculture, Water, Livestock and Fisheries, Works, Transport and Communication, Health, Community Development, Gender, Elderly and Children, Lands, Housing and Human Settlement Development, Industries & Trade, Education, Science, Technology and Vocational Training, Finance and Planning, Deep sea, Immigration, and Academic and research institutions, LGAs, Private sectors, NGOs and development partners	By 2024	Research on invasive species is undertaken based on priority needs
OBJECTIVE 4: ENHANCE STAKEHOLDER'S EDUCATION, AWARENESS AND MANAGEMENT OF INVASIVE SPECIES				
4.1: At least 50% of stakeholders are aware of various invasive species management options by 2024	4.1 1: <i>Develop and implement community educational and awareness programs on invasive species</i>	Ministries responsible for Forest, Wildlife, Tourism, Agriculture, Water, Livestock and Fisheries, Works, Transport and Communication, Health, Community Development, Gender, Elderly and Children, Lands, Housing and Human Settlement Development, Mining, Industries & Trade, Education, Science, Technology and Vocational Training, Finance and Planning, Deep sea, Immigration, Information, Youth, Culture and Sports, Teacher's training Colleges, and Academic and research institutions, LGAs, Development partners, Private sectors, NGOs, CBOs, Faith based organization.	By 2024	Stakeholder base is increased and stakeholder awareness of and management of invasive species is improved.

TARGET	ACTION	RESPONSIBILITY	TIMEFRAME	INDICATORS
	4.1.2: Promote behavioural change to mitigate introduction and spread of invasive species	Ministries responsible for Education & Vocational Training, Home affairs, Information, Youth, Culture and Sports, Academic and research institutions, Faith based organization, CBOs, NGOs, LGAs, Teachers' training Colleges and Development partners.	By 2024	Decrease in the rate of introduction and spread of new invasive species
	4.1.3: Mainstream invasive species modules from primary to higher learning institutions	Ministries responsible for Livestock, Fisheries, Forest, Wildlife, Tourism, Agriculture, Health and Social Welfare, Industries & Trade, Communication & Science and Technology, Education & Vocational Training, Academic and research institutions, Faith based organization, Private sectors, NGOs, CBOs, Development partners.	By 2024	Decrease in the rate of introduction and spread of new invasive species Increase in the numbers of appropriately-trained people (at tertiary or post-graduate levels) involved in the management of invasive species
	4.1.4. Strengthen technical capacity of Extension Service Providers on IS management	Ministries responsible for Livestock, Fisheries, Forest, Wildlife, Tourism, Agriculture, Trade , Water, Land, Human Settlements, Education, Science and Technology, Vocational Training, Transport, Infrastructure, Deep sea, Immigration, Health, Community Development, Gender, Elderly and Children, Finance, Academic and research institutions, LGAs, Private sectors, NGOs, CBOs, Faith based organizations, Development partners	By 2024	Increased skills in the management of invasive species

TARGET	ACTION	RESPONSIBILITY	TIMEFRAME	INDICATORS
4.2: At least 50% of stakeholders participated in managing invasive species by 2024	4.2.1: Mainstream invasive species management into national communication strategy	Ministries responsible for Environment, Forest, Wildlife, Tourism, Agriculture, Water, Livestock and Fisheries, Works, Transport and Communication, Health, Community Development, Gender, Elderly and Children, Lands, Housing and Human Settlement Development, Industries & Trade, Education, Science, Technology and Vocational Training, Finance and Planning, Deep sea, Immigration, and Academic and research institutions, LGAs	By 2024	Extent of presence of invasive species management issues into the reviewed National Communication Strategy on environmental sustainability, growth and poverty reduction
	4.2.2: Recognize exemplary performance in invasive species management	Ministries responsible for Environment, Forest, Wildlife, Tourism, Agriculture, Water, Livestock and Fisheries, Works, Transport and Communication, Health, Community Development, Gender, Elderly and Children, Lands, Housing and Human Settlement Development, Industries & Trade, Education, Science, Technology and Vocational Training, Finance and Planning, Deep sea, Immigration, and Academic and research institutions, Academic and research institutions, LGAs.	By 2023	Communities increase their invasive species management efforts Best lessons recorded and adopted Level of community awareness on management of invasive species

TARGET	ACTION	RESPONSIBILITY	TIMEFRAME	INDICATORS
	4.2.3: <i>Incorporate invasive species management into national and international environmental events</i>	Ministries responsible for Environment, Forest, Wildlife, Tourism, Agriculture, Water, Livestock and Fisheries, Works, Transport and Communication, Health, Community Development, Gender, Elderly and Children, Lands, Housing and Human Settlement Development, Industries & Trade, Education, Science, Technology and Vocational Training, Finance and Planning, Deep sea, Immigration, and Academic and research institutions, LGAs	By 2024	Stakeholder base is increased and stakeholder awareness of and management of invasive species is improved.
	4.2.4: <i>Create consistent and timely messaging platforms on invasive species</i>	Ministries responsible for Environment, Forest, Wildlife, Tourism, Agriculture, Water, Livestock and Fisheries, Works, Transport and Communication, Health, Community Development, Gender, Elderly and Children, Lands, Housing and Human Settlement Development, Industries & Trade, Education, Science, Technology and Vocational Training, Finance and Planning, Deep sea, Immigration, and Academic and research institutions, LGAs	By 2024	Stakeholder base is increased and stakeholder awareness of and management of invasive species is improved.

TARGET	ACTION	RESPONSIBILITY	TIMEFRAME	INDICATORS
OBJECTIVE 5: MAINSTREAMING INVASIVE SPECIES MANAGEMENT INTO REGULATORY TOOLS 5.1: At least 50% of all regulatory tools in Tanzania are revised and operationalized by 2022	5.1.1: Review and mainstream invasive species management into regulatory tools	Ministries responsible for Environment, Forest, Wildlife, Tourism, Agriculture, Water, Livestock and Fisheries, Works, Transport and Communication, Health, Community Development, Gender, Elderly and Children, Lands, Housing and Human Settlement Development, Industries & Trade, Education, Science, Technology and Vocational Training, Finance and Planning, Deep sea, Immigration, and Academic and research institutions, LGAs, Private sectors, NGOs	By 2022	Decrease in the rate of introduction of new invasive species to Tanzania Increase in compliance to rules and regulations underlying introduction/movement of biological materials Successful prosecutions of offenders
	5.1.2: Harmonize conflicting regulatory tools for managing IS	Ministries responsible for Environment, Forest, Wildlife, Tourism, Agriculture, Water, Livestock and Fisheries, Works, Transport and Communication, Health, Community Development, Gender, Elderly and Children, Lands, Housing and Human Settlement Development, Industries & Trade, Education, Science, Technology and Vocational Training, Finance and Planning, Deep sea, Immigration, and Academic and research institutions, LGAs, Private sectors, NGOs	By 2022	Regulatory tools are complementary and not conflicting

TARGET	ACTION	RESPONSIBILITY	TIMEFRAME	INDICATORS
	5.1.3: Mainstream invasive species issues into local charters, sectorial ministries, local government plans and private sector plans and guidelines	Ministries responsible for Environment, Forest, Wildlife, Tourism, Agriculture, Water, Livestock and Fisheries, Works, Transport and Communication, Health, Community Development, Gender, Elderly and Children, Lands, Housing and Human Settlement Development, Industries & Trade, Education, Science, Technology and Vocational Training, Finance and Planning, Deep sea, Immigration, and Academic and research institutions, LGAs, Private sectors, NGOs	By 2019	Decrease in the rate of introduction of new invasive species to Tanzania Stakeholder base is increased and stakeholder awareness of and management of invasive species is improved
5.2: All existing regulatory tools on invasive species are enforced effectively by 2020	5.2.1 Identify and capacitate agencies responsible for enforcement of regulatory tools on invasive species	Ministries responsible for Environment, Forest, Wildlife, Tourism, Agriculture, Water, Livestock and Fisheries, Works, Transport and Communication, Health, Community Development, Gender, Elderly and Children, Lands, Housing and Human Settlement Development, Industries & Trade, Education, Science, Technology and Vocational Training, Finance and Planning, Deep sea, Immigration, and Academic and research institutions, LGAs, Private sectors, NGOs	By 2019	Decrease in the rate of introduction of new invasive species to Tanzania Stakeholder base is increased and stakeholder awareness of and management of invasive species is improved

TARGET	ACTION	RESPONSIBILITY	TIMEFRAME	INDICATORS
	5.2.2: Develop risk assessment process for effective enforcement of regulatory tools	Ministries responsible for Environment, Forest, Wildlife, Tourism, Agriculture, Water, Livestock and Fisheries, Works, Transport and Communication, Health, Community Development, Gender, Elderly and Children, Lands, Housing and Human Settlement Development, Industries & Trade, Education, Science, Technology and Vocational Training, Finance and Planning, Deep sea, Immigration, and Academic and research institutions, LGAs, Private sectors, NGOs	By 2020	Number of identified risks on invasive species and level of mitigation
	5.2.3: Define roles and responsibilities of all agencies responsible for regulating invasive species	Ministries responsible for environment	By 2020	Regulatory agencies are complementary and not conflicting
OBJECTIVE 6: STRENGTHEN AND PROMOTE STRONG COLLABORATION AND CO-ORDINATION WITH RELEVANT STAKEHOLDERS ON MANAGEMENT OF INVASIVE SPECIES				
6.1: By 2025, collaboration and coordination on the management of IS among stakeholders increased by at least 50%	6.1.1: Strengthen trans-boundary partnerships on management of IS	Ministries responsible for Environment, Foreign Affairs and East African Cooperation, LGAs, NGOs, Private sectors & Development partners	By 2019	Increase in the number of joint operations to manage IS Decrease in rate of introduction of new invasive species

TARGET	ACTION	RESPONSIBILITY	TIMEFRAME	INDICATORS
	6.1.2: Establish coordination and communication mechanism for effective management of invasive species for all relevant stakeholders	Ministries responsible for Environment, Forest, Wildlife, Tourism, Agriculture, Water, Livestock and Fisheries, Works, Transport and Communication, Health, Community Development, Gender, Elderly and Children, Lands, Housing and Human Settlement Development, Industries & Trade, Education, Science, Technology and Vocational Training, Finance and Planning, Deep sea, Immigration, and Academic and research institutions, LGAs, Private sectors, NGOs, CBOs	By 2019	Stakeholder base is increased and stakeholder awareness of and management of invasive species is improved Decrease in the rate of introduction of new invasive species to Tanzania Early detection of new invasions
6.2: By 2025 collaboration and co-ordination among stakeholders promoted by at least 50%	6.2.1: Develop and implement an effective system for collaboration and coordination on IS management among stakeholders	Ministries responsible for Environment, Forest, Wildlife, Tourism, Agriculture, Water, Livestock and Fisheries, Works, Transport and Communication, Health, Community Development, Gender, Elderly and Children, Lands, Housing and Human Settlement Development, Industries & Trade, Education, Science, Technology and Vocational Training, Finance and Planning, Deep sea, Immigration, and Academic and research institutions, LGAs, Private sectors, NGOs & Development partners.	By 2019	Number of stakeholders and availability of communication strategy and active forums on management of invasive species

TARGET	ACTION	RESPONSIBILITY	TIMEFRAME	INDICATORS
	6.2.2: Monitor and evaluate cross-sectorial coordination and collaboration on the IS management	Ministries responsible for Environment, Forest, Wildlife, Tourism, Agriculture, Water, Livestock and Fisheries, Works, Transport and Communication, Health, Community Development, Gender, Elderly and Children, Lands, Housing and Human Settlement Development, Industries & Trade, Education, Science, Technology and Vocational Training, Finance and Planning, Deep sea, Immigration, and Academic and research institutions, LGAs, CBOs	By 2019	Number of periodical reviews conducted and resolutions drawn from monitoring and evaluation results on invasive species management
	6.2.3: Develop and implement a framework for quarterly reporting on IS issues	Ministries responsible for Environment, Forest, Wildlife, Tourism, Agriculture, Water, Livestock and Fisheries, Works, Transport and Communication, Health, Community Development, Gender, Elderly and Children, Lands, Housing and Human Settlement Development, Industries & Trade, Education, Science, Technology and Vocational Training, Finance and Planning, Deep sea, Immigration, and Academic and research institutions, LGAs, Private sectors, NGOs and relevant stakeholders	By 2019	Number of quarterly reports prepared and shared to stakeholders Level of implementation of the IS Strategy

4.0 IMPLEMENTATION, MONITORING AND EVALUATION PLAN

4.1 Implementation of the NISSAP

4.1.1 Prioritization of Actions and Areas

Resources for managing IS are limited, which makes prioritization unavoidable. In this regard, the proposed implementation actions shall be categorized into three levels, namely critical, high priority and medium priority as elaborated hereunder and in Appendix 15.

i) Critical actions

Those essential to the successful implementation of the Strategy and should be initiated as soon as possible, within one year of the endorsement of the Strategy;

ii) High priority actions

Those essential to the successful implementation of the Strategy and should also be initiated as soon as possible but in many cases their implementation is contingent upon prior actions being undertaken; and

iii) Medium priority actions

Those actions that are deemed to be of value but are not essential to the successful implementation of the Strategy. In some cases contingent upon the undertaking of high priority actions. In other cases, it is deemed that they would be of value but are not essential to the successful implementation of the Strategy.

Likewise, areas with critical ecosystem services such as nature reserves, national parks, catchment forests, game reserves, riverine, wetland and marine and coastal ecosystems are highly categorized for management programmes to target well-established invaders, but also give appropriate attention to emerging problems.

4.1.2 Co-ordination

The implementation of this Strategy will be guided by the National Environmental Management Act (EMA), 2004 and shall be operated and institutionalized following the institutional arrangement as described in Chapter Two (Section 2.10). The overall coordination of the Strategy will be under the Vice President's Office (VPO). At national level, the Biodiversity Conservation Section within VPO shall work with sector ministries for implementation of the Strategy. The Ministries shall formulate sectoral policies and legislations and shall be responsible for mainstreaming of NISSAP into their sectors. Regional secretaries and Local Government Authorities (LGAs) should mainstream and implement the strategic interventions at their areas of jurisdictions. Private sectors, NGOs, Civil Society Organizations, Religious Organizations, Education and Research Institutions shall participate by facilitating the implementation of specific actions at a community level.

4.2 Monitoring, Evaluation and Learning

This section provides the mechanism for monitoring, evaluation and learning implementation framework for the period of ten years of the NISSAP covering the period from financial year 2019/20 to 2029/30. Furthermore, this section will provide information on periodic reviews,

assessment and evaluation of the effectiveness, efficiency, impact and sustainability on implementation.

Monitoring and Evaluation shall be a participatory process. A framework for monitoring and evaluation (M & E) plan of invasive species in Tanzania is a crucial step and an essential mechanism to ensure this NISSAP achieve the anticipated results. Monitoring and evaluation provides the public, government and other concerned resource agencies and partners with information on the progress and results of NISSAP implementation.

4.2.1 Monitoring Plan

Monitoring will involve continuous and systematic data collection, analysis, indicator assessment, interpreting and reporting based on set indicators (Table 12). This will further provide information to the Ministry responsible for Environment and stakeholders on ongoing interventions, for the purpose of assessing the extent of progress and achievements made over the objectives and the use of allocated resources.

4.2.1.1 Multi-sectoral Reviews

The planned reviews will be conducted by the Ministry responsible for Environment and other stakeholders. This will consist of review meetings, planned indicators reviews and rapid appraisals including their frequencies. This will help to improve management, decision making, encouraging internal and external transparency and accountability.

4.2.1.2 Performance Review Meetings

Performance review meetings will be conducted by the Ministry responsible for Environment and other stakeholders to track the progress against Targets and Indicators set (Table 13).

Table 13: Performance Review Meeting Plan

No.	Type of Meeting	Frequency	Chairperson	Participants
1	Division Meetings/ VPO*	Quarterly	DE**	Assistant Directors and Officers - DE and DPP***
2	Sector Directors Meetings	Quarterly	DE	Sector Directors
3	Steering Committee Meetings	Bi-annual	Permanent Secretary	Sector Permanent Secretaries
4	Sector Ministers Meetings	Annual	Minister for Environment	Sector Ministers
5	Stakeholders Meeting	Annual	Permanent Secretary	Relevant Stakeholders

Note: VPO *= Vice President's Office; **DE=Director of Environment; DPP*** = Director of Policy and Planning

4.2.1.3 Indicators Review

Indicator review will focus on determining whether or not the planned activities are being implemented towards achieving the Annual Targets and will find out if the implementation is on track, off track, or at risks. The findings obtained from the Indicators reviews will be used to adjust the implementation Strategies and Targets accordingly.

4.2.1.4 Performance Evaluation Plan

Performance evaluation will be a periodic assessment on achievement of NISSAP Objectives and Targets. During the ten years of the Implementation of the NISSAP, five annual evaluations will be conducted after every two years. These evaluations will assess progress towards attainment of NISSAP Objectives and Targets. The final evaluation will be conducted to obtain evidence as to whether the NISSAP Objectives and Targets have been achieved. The approach with which evaluation of the Strategy will be done has been developed and summarized as the Evaluation Plan Matrix which provides among other things, methods and indicators for establishing and assessing the level of success and effectiveness of the Strategy by responsible stakeholders. Again this should be adjusted and be made specific by each sector/stakeholder during the implementation of this Strategy.

4.2.1.5 Performance Reporting and Outreach Plan

The institutional arrangement established in EMA will be used for reporting performance and outreach. This will involve reporting on performance progress towards attainment of NISSAP Objectives and Targets or implementation of Targets against expenditures focusing on the impacts to stakeholders and community at large. The report shall also include reports on sighting of unusual plant/animals at every administrative level. The Reporting Plan will detail on internal and external reporting.

4.2.5.1.1 Internal Reporting Plan

Ministries, Departments and Agencies (MDAs) and Local Government Authorities (LGAs) shall report to the VPO on implementation of the Strategy and any other issues on IS quarterly and annually (Table 14). In addition Regional and District Environmental Management Officers (REME/DEMO) shall report on implementation of the Strategy and any other issues on IS to MDAs. Finally sub-village (Kitongoji) Environmental Management Officers (EMO) shall report on implementation of the Strategy to Village, Wards and Districts Environmental Management Officers. However, information on unusual plant or animal species seen at Sub-village (Kitongoji) level shall immediately be reported to the Environmental Officer of the respective Sub-village who shall fill in the reporting form (Appendix 11). These reports will provide an overview of implementation progress of NISSAP Objectives and Target against used resources and any emerging issue regarding IS.

Table 14: Internal Reporting Plan

No.	Type of Reports	Frequency	Report initiator	R. 1	R.2	R. 3	Final Recipient
	Progress reports	Quarterly	EMO	DEMO	REME	MDAs	VPO
	Progress reports	Annually	EMO	DEMO	REME	MDAs	VPO

Note: R= Recipient; EMO=Environmental Management Officer; DEMO=District Environmental Management Officer; REME= Regional Environmental Management Expert; MDAs= Ministries, Departments and Agencies; VPO= Vice President's Office.

4.2.5.1.2 External Reporting Plan

The external reporting will be done by the VPO and will involve compilation of annual and midterm reports on implementation of the Strategy and any other issue regarding to IS. The VPO shall disseminate the report to MDAs and further to REME, DEMO and EMO (Table

15). Dissemination to the general public shall be in the form of reports published in the VPO official website or addressed through educational platforms such as, workshops, seminars, public meetings, conferences, tours, and participation in national and international days with themes related to environment. Mass Media platforms like radio, television, newspapers, sectoral websites, social media and e-mail shall also be used.

Table 15: External Reporting Plan

No.	Type of Reports	Frequency	Report disseminator	R. 1	R. 2	R. 3	R. 4	Final recipient
	Mid-term	once	VPO	MDAs	REME	DEMO	EMO	General public
	Annual	once	VPO	MDAs	REME	DEM	EMO	General public

Note: R= Recipient; VPO= Vice President's Office; EMO=Environmental Management Officer; DEMO=District Environmental Management Officer; REME= Regional Environmental Management Expert; MDAs= Ministries, Departments and Agencies.

4.2.2 Evaluation Plan

The evaluation process provides the feedback that triggers adjustments to actions, plans and budgets, to ensure that they are realistic and are being adhered to. The implementation of NISSAP provides a management direction in terms of goals, objectives, actions, standards and guidelines, all of which are based on underlying working assumptions about the scientific knowledge on IS.

The NISSAP national implementation team will continue to strengthen the collaborative working relationships between stakeholders responsible for the implementation of this strategy and action plan. A joint committee of stakeholders will implement this M & E Plan and conduct implementation monitoring and evaluation including: preparing an annual monitoring program, collecting data for implementation, effectiveness, and validation monitoring; collaborating with responsible stakeholders for data collection, and analyzing and interpreting monitoring data and reporting monitoring results, conclusions and evaluation recommendations to respective responsible stakeholder, and making these reports available to the public and other agencies. To achieve this, the Objectives and Targets of the Strategy have been used to formulate the M & E by translating them into Goals and Objectives in one level that has enabled the development of *Evaluation Plan Matrix*. This Evaluation Plan Matrix is presented in Appendix 14.

5.0 INDICATIVE EXPENDITURE BUDGET

5.1 Resource Mobilization for Implementation

Effective Implementation of the NISSAP in Tanzania shall depend on various sources including government subventions, bilateral and multilateral agreements, grants, private sector and individual contributions. Potential sources of internal funds shall include revenue collected by the Government through taxes and charges from various investments associated with biodiversity and ecosystem utilization. Such funds shall be allocated to various Ministries, Departments and Agencies (MDAs) and Local Government Authorities (LGAs) through their Expenditure Framework that will be reflected in their budgets. Implementation of sectoral NISSAPs shall be supported under this arrangement. Other sources of domestic funds shall include established funds such as National Environmental Trust Fund, Tanzania Wildlife Protection Fund, Tanzania Forest Fund, Payments for Environmental Services (for example, Payment for Ecosystem Services-PES); funds obtained through Public Private Partnerships and funds from local NGOs.

Potential sources of funds for NISSAP implementation from the international community shall include GEF, the World Bank, EU, USAID, CIDA, SIDA, DANIDA, among others. GEF serves as financial mechanism for a number of conventions including Convention on Biological Diversity (CBD). In undertaking its activities, GEF operates with its agencies that include: the United Nations Development Programme (UNDP); United Nations Environment Programme (UNEP); UK Research and Innovation Fund; Food and Agricultural Organization of United Nations (FAO), United Nations Industrial Development Organizations (UNIDO), International Fund for Agricultural Development (IFAD), Global International Water Association Fund (GIWA), the European Bank for Reconstruction and Development and the Inter-American Development Bank. Other potential sources of funds include Bilateral Funds and General Budget Support (GBS). NISSAP implementation shall also benefit from financial support directed at specific themes such as climate change.

5.2 Proposed Indicative budget

The summary of indicative costs for implementation of NISSAP is shown in Table 16 and detailed budget description has been presented in Appendix 16. In order to execute this Strategy and Action Plan approximately **TZS 73,860,000,000.00** is required. The budget is distributed in a manner that shows the amount required to achieve each of the stated six Strategic Objectives. A large proportion of the budget (33.6%) is allocated to attain the fourth Objective which aims at enhancing stakeholder's education, awareness and management of invasive species. Another substantial amount (26%) will be used to attain the third Strategic Objective which aims at enhancing capacity in management, training and research on invasive species. Since an Objective 5 & 6 has to do with regulatory issues, it is proposed that these areas have to be fully supported by the government. For other remaining Objectives other stakeholders can take part in collaboration with the government. It is therefore proposed that a ratio of 0.5 (50%) be applied for Objective 1, 2 and 3 and a ratio of 0.7 (70%) for Objective 4. This means 50% and 70% be contributed by the Government while the rest be contributed by other stakeholders. In this case 63% of the budget has to be fully supported by the Government and the remaining 37% can be contributed from other sources.

Table 16: A summary of indicative budget for Implementation of the NISSAP

S/ no.	Strategic objective	Estimated cost (Tzs)	% of the total budget	Government (TZS)	Others (TZS)
1	SO1: Prevent introduction and spread of new invasive species	9,580,000,000	13.0	4,790,000,000	4,790,000,000
2	SO2: Reduce negative impacts of existing priority invasive species	11,440,000,000	15.5	5,720,000,000	5,720,000,000
3	SO3: Enhance national capacity in management and research on invasive species	19,235,000,000	26.0	9,617,500,000	9,617,500,000
4	SO4: Enhance stakeholder's education, awareness and management of invasive species	24,845,000,000	33.6	17,391,500,000	7,453,500,000
5	SO5: Mainstreaming invasive species management into regulatory tools	7,920,000,000	10.72	7,920,000,000	0
6	SO6: Strengthen and promote strong collaboration and co-ordination with stakeholders on management of invasive species	840,000,000	1.14	840,000,000	0
	GRAND TOTAL	73,860,000,000	100.00	46,279,000,000	27,581,000,000

Note: SO = Strategic Objective

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APPENDICES

Appendix 1: A list of National Task Force Team Members who took part in the preparation of NISSAP 2019-2029

S/N	Name	Position	Organisation/ Institutional Affiliation	Email address	Area of Expertise
1.	Dr. Ezekiel E. Mwakalukwa	Chair	Forestry & Beekeeping Division	ezedwa@gmail.com; ezekiel.mwakalukwa@maliasili.go.tz	Plant Ecology& Forest Governance
2.	Dr. Maurus J. Msuha	Assistant Chair	Ngorongoro Conservation Authority (NCA)	maurus.msuha@gmail.com	Wildlife ecology & social science, Strategic planning
3.	Dr. Catherine A. Masao	Secretary	University of Dar es salaam- Institute of Resources Assessment	ndeutz@yahoo.com; catherine.mmbaga@gmail.com	Applied Ecology, Biodiversity/ Tropical Ecosystems Management, policy analysis & socio-ecological surveys
4.	Dr. William Kindeketa	Assistant Secretary	COSTECH	william.kindeketa@gmail.com	Biodiversity, forester, database management (content), policy analysis
5.	Mr. Sanford Kway	Member	PO-RALG	Sanford.Kway@tamisemi.go.tz	Forester, policy analysis and social analysis
6.	Eng. Simlizi Kissina	Member	Ministry of Water	kissinae90@yahoo.com	Water Resources specialist
7.	Mr. Juma Mwinyimkuu	Member	Ministry of Agriculture	allymmm@yahoo.com	Plant protection (phytosanitary issues), project management
8.	Dr. Angello Mwilawa	Member	Ministry of Livestock and Fisheries	Ajmwilawa@yahoo.com; angelo.mlawa@mifugo.com	Pastures & Range management, monitoring of range management, improvement of rangelands, Social analysis
9.	Mr. Maneno Chidege	Member	TPRI	mchidege@yahoo.com; maneno.chidege@tpri.go.tz	Pest management specialist (IPM techniques), insect inventories
10.	Ms. Yustina A. Kiwango	Member	TANAPA	ykiwango@yahoo.com; yustina.kiwango@tanzaniaparks.go.tz	Ecosystem health and management, (Wetlands management), strategic plan
11.	Dr. Bukombe John	Member	TAWIRI	bukombe2017@gmail.com; bukombe.john@tawiri.or.tz	Wildlife Ecology (foraging), mapping & impact assessments of invasive species

S/N	Name	Position	Organisation/ Institutional Affiliation	Email address	Area of Expertise
12.	Dr. John R. Mbwapbo	Member	TAFORI	jorijomb@yahoo.com; john.richard@tafori.or.tz	Plant ecology/ Invasion Biology, risk assessment, plant identification
13.	Dr. Linus Munishi	Member	NM-AIST	linus.munishi@nm-aist.ac.tz	Evolutionary & Restoration Ecology, natural resource management & Climate change, bio-statistician & animal genetics, Research-Policy interface
14.	Ms. Fainahappy Kimambo	Member	VPO	fainahappy.kimambo@vpo.go.tz	Animal Science & Natural Resource Management, strategic plan, policy analysis
15.	Dr. Charles J. Kilawe	Member	SUA	ckilawe@sua.ac.tz	Spatial Ecology & Geography, participatory mapping, Sustainable Land Management Practice, data analysis
16.	Dr. Oliver C. Nyakunga	Member	CAWM, Mweka	onyakunga@mwekawildlife.ac.tz; onyakunga@gmail.com	Wildlife & Fire Ecology, plant response, planning & management; Biostatistics
17.	Mr. Hillary Mrosso	Member	TAFIRI	hillarymrosso@tafiri.go.tz; hjmrosso@yahoo.com	Aquatic ecology, database content management & GIS
18.	Dr. Isakwisa Ngondya	Member	TAWA	ingondya@yahoo.com; ngondya@gmail.com	Restoration Ecology, plant ecology, traditional techniques to manage invasive species, Prosecution (Wildlife related cases)

Appendix 2: Visited sites during fieldwork consultations and observations

S/ No.	Name of Institution/ Individuals	Location	Type of Institution	Species/ Habitat	Reason (s) for Visit
1.	Lake Victoria Environmental Management Project II (LVEMPII)	Mwanza	Government	Aquatic	Scale and nature of the problem (it touches issues of water, industries and fisheries activities)
				Water hyacinth	Abundant, success stories, list of projects, information, challenges of BC, option for utilisation, management costs

S/ No.	Name of Institution/ Individuals	Location	Type of Institution	Species/ Habitat	Reason (s) for Visit
				Sangara	Utilisation challenges, control projects, community perceptions, Impacts
				Sato	Utilisation challenges, control projects, community perceptions, impacts
2.	National Agricultural Ranch Cooperation (NARCO), TALRI, Kongwa DC and Kibaigwa Community	Kongwa	Government	Pastures	Work with a range of IAS in pasturelands
				Astrapomea	First introduction and magnitude of the problem including spread and impacts, existence of detailed research information
3.	Serengeti NP	Serengeti	Government	Conserved area (Guternbergia and Chromolaena)	Seek for support and partnership in prevention, eradication and control of IAS, Scale and nature of the problem
	Serengeti DC - SEDEREC		Government	Farmland/ Grazinglands	Impacts on livelihood activities, distribution, management
4.	Grunnet - Serengeti		Community	Conserved area	Seek for support and cooperation/ partnership in eradication, prevention and control of IAS, Success stories, Management techniques, challenges
	Serengeti - Community		NGO	Chromolaena	Impacts on livelihood activities
5.	Ngorongoro Conservation Area	Ngorongoro	Government	Guternbergia	Nature and extent of the problem to both livestock and Wildlife, First evidence based IS management initiatives in Pas in Tanzania, success stories
				Bidens spp	Impacts, management techniques

S/ No.	Name of Institution/ Individuals	Location	Type of Institution	Species/ Habitat	Reason (s) for Visit
			Lodges and Hotels	Tagetes Acacia Shieldburg	Impacts, management techniques Rapid response to IAS, Experience on use of Chemicals to control IAS in Pas Support and Cooperation/ partnership in prevention, eradication and control
6.	Tropical Pesticides Research Institute-TPRI		Government	Variety Tuta absoluta Fall armyworm Pesticides	Custodian of useful options for rapid response and effective management options, success stories, Bio control experiences and management Observe magnitude, control success stories, impacted communities Observe magnitude, control success stories, impacted communities Uses and impacts, experience and community perceptions
7.	Nyumba ya Mbungu - Pangani Basin Water Body Moshi Office	Mwanga	Government	Water and Grazinglands Prosopis	Magnitude of problem of hydro power production, livestock and fisheries activities
8.	Same DC (Mohamed Enterprises and TANROADS - Moshi Office)	Same		Callotropis sp	Mode of dispersal, impact and control
9.	Arusha NP		Government	Caesalpinia Lantana Datura	One of most affected NP and has experience on effectiveness of various approaches

S/ No.	Name of Institution/ Individuals	Location	Type of Institution	Species/ Habitat	Reason (s) for Visit
			Lodges and Hotels		Support and Cooperation/ partnership in prevention, eradication and control
10.	SAO Hill		Government	Acacia mearnsii Climber	Experience and effectiveness of management strategies, Economic Impact on Forest Plantations Effect of fire on Forest plantation management, Distribution and Status
11.	Dar es Salaam		Government	Marine Parks (IMS)	Places to find information about sea IAS, management techniques, projects undertaken
		Dar City		DCC (Indian House crow, flying nursery) WWF/IUCN/ DFID/Jane Goodall Institution	Managemnet project, Impacts and perceptions, Bio control effect Seek for their support, opinions and experience from other places on Management of IAS, projects undertaken, Impact established
12.	Flying nurseries (in big cities)		Community		Champions of change, Regulation of activities, pathways, demand
13.	Mahale Ecosystem	Kigoma	National Parks	Senna spectabilis	Experience on management of conflict species
		Muyoyosi/ Malagarasi/ Ugalla	Wetland	Aquatic invasive	Ramsar site - Potential source of invasion for Lake Tanganyika

Appendix 3: A summary of some of projects on Invasive Species implemented in Tanzania

S/N	Name/Title of the Research Project/ Consultancy Dealing with invasive species	Institution Name & Contact person	Location of the project (s)	Project aim and Objectives	Name/Scope of invasive species worked (working) on	Key findings/Management issues	Recommendations
1.	Control of <i>Astripomoea hyoscarnoides</i> a noxious weed in pastures of central	TALIRI Mpwapwa; Temu, V et al. 2002	On Station - TALIRI Mpwapwa and TALIRI Kongwa	To study different characteristics of the weed as regards growth and seed production	Spread of Kongwa weed (Mahata) is through seeds;	Preliminary results showed that slashing at the active growth stage alone could reduce the weed density from 5 to 2 plants / m ² . This implies that there is a possibility of controlling the weed by mechanical means, which will prevent it from setting seeds. There was also an increase in the yield of grasses of about half a tone/ha.	Further Research on Biological and Chemical Control; Did NOT continue due to limited funds and researchers
2.	Assessment of Farmers Perceptions on the Status of <i>Astripomoea Hyoscarnoides</i> (Kongwa Weed) Invasiveness in Central Tanzania	SUA Nkombe B, Sangedda A, Sibuga K, Hermansen J (2018)	Kongwa District	To determine the growth stage at which the weed is most vulnerable to different	<i>Astripomoea Hyoscarnoides</i> (Kongwa Weed -Mahata)	Currently, the weed is managed through uprooting; frequent cutting prior to seed setting; Community is aware of the source of spread; little initiative toward control of the weed. However, farmers are positive to contribute towards the control of the weed through sustainable land management strategies or integrated weed management approaches, if relevant technical assistance is offered; need of baseline data for monitoring the direction of spread and abundance; in order to strategically control further	Use the mechanical Control uprooting and frequency of cut; Range management; Further research with Chemical and Biological control methods; Knowledge dissemination on IAS and Capacity building about the weed

S/N	Name/Title of the Research Project/ Consultancy Dealing with invasive species	Institution Name & Contact person	Location of the project (s)	Project aim and Objectives	Name/Scope of invasive species worked (working) on	Key findings/Management issues	Recommendations
3.	Invasive plant species (<i>Chromolaena odorata</i>) threat to livestock production in the lake and north eastern zones of Tanzania ;	TALIRI, Mabuki; Mwilawa, A.J. et al 2017	Kenyamota ward, Serengeti District	Control measures.	Effectes of <i>C. Odorata</i> “Amachabongo”; Most of the villages in Kenyamota and other many villages visited were infested	The invasive spp Amachabongo were heavily infested in more than 21 villages but is spread in many other villages; Currently control is through mechanical removal; The infested area has soils emanating from all three types of rocks (Igneous, Metamorphic, and Sedimentary) as parent materials ; Although <i>Chromolaena odorata</i> was the least preferred by goats but it was reasonably eaten	Further research to leaf meal use in goats feed rations; Training on Rangelands management among farmers; Government to strengthen the proper use of communal grazing lands through by-law;
4.	Habitat Management for Biodiversity and Improvement of Tourism in Arusha National Park and Enhancement of Livelihoods of Local Communities’	Mweka-MOSHI and ARUSHA NP	Arusha National Parks (sites were: Kusare area close to Kusare road junction; .close to Mlima Sadi-ki.; Uwanja wa Mbogo	To determine the most effective method for the control of the weed.	Growing thick vegetation of some invasive species hindering visibility of NP to tourist	The mechanical removal of thickets of the invasive species has revealed enhancement of visibility of tourist attractions and hence visitors’ satisfaction; • Control of human wildlife conflicts using non-lethal methods in line with various supports on community-based tourism in the areas enhances positive attitudes of local communities towards the park and hence good relationship between the two.	Mechanical removal of <i>C. decapetala</i> should start at the high altitudes towards the low altitudes so as to avoid seeds re-dispersal by water to mechanically treated sites.

S/N	Name/Title of the Research Project/ Consultancy Dealing with invasive species	Institution Name & Contact person	Location of the project (s)	Project aim and Objectives	Name/Scope of invasive species worked (working) on	Key findings/Management issues	Recommendations
5.	Allelopathic effect of <i>Chromolaena odorata</i> aqueous leaf extract on seed germination and seedling growth of selected crops and pastures species	SUA; Mtengeti and Muzzo,	Lab at DAARs SUA; Kenyamota, Serengeti	To determine the economics of the different control measures.	Odorata aqueous leaf extract on other crops	<i>C. odorata</i> leaf extract inhibited seed germination and seedling growth of some crops and pasture species	Further investigation is needed on the allelopathic behavior under field conditions and inhibitory mechanism involved
6.	Prediction of Suitable Habitat for Potential Invasive Plant Species <i>Parthenium hysterophorus</i> in Tanzania	TAWIRI, Arusha; J. Bukombe Kijal et al., 2013: A Short Communication	Arusha and Arumeru districts in Arusha region, northern Tanzania	To identify areas of bioclimatic variables that are suitable for the growth of <i>Parthenium hysterophorus</i>	Only fifteen of the nineteen bioclimatic variables were important for the growth of <i>P. hysterophorus</i> in the country	The results suggested that MaxEnt modeling and jackknife were suitable approaches in identifying areas of potential invasion in Tanzania.	Prompt use of the current results may help in field surveys and prioritization of conservation and restoration efforts
7.	Distribution of Invasive Weed <i>Parthenium hysterophorus</i> in Natural and Agro-Ecosystems in Arusha Tanzania	TPRI, Arusha; Ramadhan Kilewa and Amzath Rashid	Njiro suburb, Arusha Kilimanjaro border and Arusha Airport in Arusha	Two objectives: 1) to identify areas infested with <i>parthenium</i> weed in Arusha region in Tanzania 2) to determine	The weed was found growing along the roadsides, near residential areas; crop land and grazing lands in all three location	The density, frequency and abundance of <i>parthenium</i> weeds were high at Njiro suburb compared to Arusha-Kilimanjaro border and at Arusha airport.	Further research to develop effective management strategies to control.

S/N	Name/Title of the Research Project/ Consultancy Dealing with invasive species	Institution Name & Contact person	Location of the project (s)	Project aim and Objectives	Name/Scope of invasive species worked (working) on	Key findings/Management issues	Recommendations
8.	Project:Building Surveillance and Management Capacity to Effectively Respond to Fall Armyworms (FAW) in Tanzania	MoA: Sergei Mutahiwa	Not specified	density, frequency and abundance of parthenium weed in areas infested with parthenium weed. The FAW monitoring and management system at Community level strengthened, and outbreaks reduced significantly at all levels.2. To conduct surveillance to monitor the magnitude of spread/damage of FAW in Tanzania and Assess qualitative and quantitative impacts of FAW (time, money, amount and nature of pesticides uses, and food insecurity)	Fall armyworm	Work on Progress	Immature

S/N	Name/Title of the Research Project/ Consultancy Dealing with invasive species	Institution Name & Contact person	Location of the project (s)	Project aim and Objectives	Name/Scope of invasive species worked (working) on	Key findings/Management issues	Recommendations
9.	Restoration Pilot Program on Nature Based Approaches for Managing Invasive Plants <i>Bidens schimperi</i> and <i>Gutenbergia cordifolia</i> in Ngorongoro Conservation Area 2018/2019	The Nelson Mandela African Institution of Science and Technology- Dr. Issakwisa Ngondya and Dr. Linus Munishi	Ngorongoro Conservation Area (NCA)	To contribute to effective and sustainable Management of Invasive Species within and around Ngorongoro Conservation Area by analyzing the response of two invasive plants G. cordifolia na B. schimperi to varying densities and crude extract treatments of Cynodon dactylon and Desmodium species respectively	<i>Bidens schimperi</i> and <i>Gutenbergia cordifolia</i>	Over 50% suppression of invasive plants <i>Bidens schimperi</i> and <i>Gutenbergia cordifolia</i> in pilot plots	Work still in phase I

S/N	Name/Title of the Research Project/ Consultancy Dealing with invasive species	Institution Name & Contact person	Location of the project (s)	Project aim and Objectives	Name/Scope of invasive species worked (working) on	Key findings/Management issues	Recommendations
10	Survey and digital mapping of invasive alien plant species in the Ngorongoro crater, Tanzania (Funded by NCA: Tshs 52 mill)	TAWIRI, Arusha; J. Bukombe, Hamza Kija, et al., 2013	Ngorongoro Crater	use a combination of both remote sensing and ground surveys to identify, map and quantify area coverage for invaded areas and associated pathways for targeting preventative measures.	Amaranthus hybridus, Bidens pilosa, Bidens schimperii, Datura stramonium, Gutenbergia cordifolia, Solanum incanum, Tagetes minuta,	Assignment is still in progress: Preliminary analysis: <i>important pathways (species as ornamentals, vehicles, transport contaminants, road construction, grading, selective grazing. Natural spread (including water, and animal movement routes)</i>	Plan for physical approaches (uproot and burn) especially in grids with low infestations. Implement a monitoring of introductions and spread through the important pathways
11	Fire regulates the abundance of alien plant species around roads and settlements in the Serengeti National Park Activity conducted by TAWIRI in collaboration with SENAPA ecology department	TAWIRI J. Bukombe, Emilian Kihwele et al 2018	Serengeti National Park	establish a list of alien plants in the Serengeti; estimate abundance as influenced by fire frequency and human activities contributing to their spread in order to information management authorities on priority areas at risk of invasion	Listed 15 alien species	Human activities: road construction, road grading, construction of settlements and fire differentially help to regulate the spread of alien plants in the Park. except <i>Tagetes minuta</i> other species can be controlled by fire.	Plan for physical removal

S/N	Name/Title of the Research Project/ Consultancy Dealing with invasive species	Institution Name & Contact person	Location of the project (s)	Project aim and Objectives	Name/Scope of invasive species worked (working) on	Key findings/Management issues	Recommendations
12	The impact of invasive tree species <i>Cedrela odorata</i> on population of critically endangered Lizard species <i>Lygodactylus williamsi</i> at Kimboza Forest Reserve, Tanzania	SUA Charles J.Kilawe	Kimboza Forest Reserve	(1) Assessment of the extent of invasion of <i>Cedrela odorata</i> into Pandanus rabaensis vegetation (2) Assessment of the invasion impacts of <i>Cedrela odorata</i> on population of <i>Lygodactylus williamsi</i>		1) <i>Cedrela</i> covered 35% of all tree species with diameter >10 cm. except, few thick stands of Pandanus, <i>Cedrela</i> was found almost every vegetation type. There was a very strong negative correlation between abundances of <i>Cedrela</i> and Pandanus suggesting that <i>Cedrela</i> could be suppressing/replacing Pandanus. 2) There was not sufficient evidence to conclude that <i>C.odorata</i> was affecting in anyway the population of lizard species, <i>L.williamsi</i> . Generally, significant larger populations of <i>Lygodactylus williamsi</i> were found in open canopy trees than dense, regardless of vegetation type	
13	Potential Spread and Genetic Characterization of the Invasive Tree Species <i>Maesopsis eminii</i> along the Eastern Arc Mountains, Tanzania	Nelson Mandela African Institution of Science and Technology, Arusha Beatus Mwendwa	Amani Nature Forest Reserve	To determine potential spread, pattern and progressive distribution of invasive tree species <i>Maesopsis eminii</i> over the past twenty years.		-Ongoing	

S/N	Name/Title of the Research Project/ Consultancy Dealing with invasive species	Institution Name & Contact person	Location of the project (s)	Project aim and Objectives	Name/Scope of invasive species worked (working) on	Key findings/Management issues	Recommendations
14	Lake Victoria Environmental Management Project Phase 1 (LVEMP I)	Vice President Office	Lake regions (i.e Mwanza, Kagera, Shinyanga)		Water Hyacinth	Introduction of sustainable and environmentally friendly management of Water hyacinth in Lake Victoria using biological and mechanical control	Use of Bio control to reduce Water hyacinth Coverage Importance of effective monitoring and surveillance
15	Lake Victoria Environmental Management Project Phase 2 (LVEMP II)	Vice President Office and Ministry of Water	Lake regions (i.e Mwanza, Kagera, Geita, Simiyu)		Water Hyacinth	Introduction of sustainable and environmentally friendly management of Water hyacinth in Lake Victoria using biological and mechanical control	Use of Bio control to reduce Water hyacinth Coverage Importance of effective monitoring and surveillance
16	Woody invasive alien species in East Africa: assessing and mitigating their negative impact on ecosystem services and rural livelihood	TAFORI Dr. John R. Mbwambo SUA Prof. George Kajembe and Dr. Charles. J. Kilawe	Amani Nature Reserve and Kahe Ward in Moshi District Council	Assessing the relationship between abundance of the invasive and their impacts at a local level	<i>Prosopis juliflora</i> and <i>Lantana camara</i>	- Distribution maps of areas invaded with <i>Prosopis juliflora</i> in Tanzania. - Distribution maps of area invaded with <i>Lantana</i> in East Usambara	ON GOING

S/N	Name/Title of the Research Project/ Consultancy Dealing with invasive species	Institution Name & Contact person	Location of the project (s)	Project aim and Objectives	Name/Scope of invasive species worked (working) on	Key findings/Management issues	Recommendations
				- Mapping current and potential future distribution of selected woody invasive alien species in case study areas on local and country level and using this information to raise awareness of the problem - Developing and evaluating management options: biological, physical and chemical control			

S/N	Name/Title of the Research Project/ Consultancy Dealing with invasive species	Institution Name & Contact person	Location of the project (s)	Project aim and Objectives	Name/Scope of invasive species worked (working) on	Key findings/Management issues	Recommendations
17	Combating alien invasive plants threatening the East Usambara mountains in Tanzania	Tropical Biology Association, Centre for Ecology and Hydrology, Banchory, Forestry and Beekeeping Division, Sokoine University of Agriculture, Tanzania Forestry Research Institute	East Usambara Mountains	Assessing Risks associated with plant introductions IAS management strategy of the East Usambara Mountains	Invasion in the Botanical Gardens and other intentional introduction	- Species list of exotic species of Amani - Distribution and abundance of 216 exotic species in Amani Nature Reserve - East Levels of herbivory did not vary between invasive and non-invasive tree species.	(i) Risk assessment of Species in Amani Nature Reserve (ii) Establishment of management trials (mechanical, manual/ physical) before up-scaling to large scale
18	Invasion of <i>Cedrele odorata</i> in the Uluguru Mountains	Jasson John, Chelestino Balama & Edward . Mwakalukwa	Uluguru	- To assessing distribution and abundance of <i>Cedrele odorata</i> in Uluguru Mountains. - Assessing Utilization potential and people opinion on invasions	<i>Cedrele odora</i>	<i>Cedrele odorata</i> is considered as a reliable alternative timber tree species after a ban to harvest from natural forest. <i>Cedrele odorata</i> is establishing in many farmlands in Uluguru	Planting of <i>Cedrele odorata</i> should be limited to only farmlands but not for gap enrichment in forest reserves.

S/N	Name/Title of the Research Project/ Consultancy Dealing with invasive species	Institution Name & Contact person	Location of the project (s)	Project aim and Objectives	Name/Scope of invasive species worked (working) on	Key findings/Management issues	Recommendations
19	Alien Invasive Species Management Project Project Cost: This fiscal year, 2018/2019, Funded by TANAPA, TZS 567,600,000/- (and 2 billion in the past ten years).	TANAPA; Contact Mr Martin Loibooki (Director of Conservation)	Sixteen National Parks namely Arusha, Gombe Katavi, Kitulo, Kilimanjaro, Manyara, Mahale, Mkomazi, Mikumi, Ruaha, Rubondo Island, Saadani, Saanane Island, Serengeti, Tarangire and Udzungwa National Parks.	i) Eradicate new invasions ii) Control/ Manage established invasions iii) Prevent new introductions iv) Prevent spread of established invasives to other areas v) Provide continuous invasive species education to adjacent local communities	71 species (list available separately) worked on using chemical, mechanical and cultural approaches	i) Integrated approach works best ii) Same management approach for a certain species does not necessarily yield the same success rate at another site (due to differences in weather) iii) Interruption of funding for projects is catastrophic to a successful management. iv) Follow-up monitoring is mandatory, for at least 3 years, at a site where eradication seems to have been achieved, in order to detect any re-emerging invasives and hence conduct early eradication.	i) Continuous monitoring and removal ii) Research on viable options of management iii) Prevention is cheaper, resources should be directed into prevention of IS iv) Engagement of communities to tackle this problem in their areas adjacent Protected Areas.

S/N	Name/Title of the Research Project/ Consultancy Dealing with invasive species	Institution Name & Contact person	Location of the project (s)	Project aim and Objectives	Name/Scope of invasive species worked (working) on	Key findings/Management issues	Recommendations
20	Black Wattle (<i>Acacia mearnsii</i>) invasion in Chome Nature Reserve: estimating its coverage and control costs	TAFORI, Dr. John R. Mbwambo	Chome Nature Reserve, Same District, Kilimanjaro	- To evaluate the possibility of controlling <i>Acacia mearnsii</i> in Chome Nature Reserve, a part of EAMs. - To estimate the coverage and impact of <i>Acacia mearnsii</i> invasion in Chome Nature Reserve. - To estimate the costs that are needed to control the species.	Black Wattle – <i>Acacia mearnsii</i>	<i>Acacia mearnsii</i> is estimated to occupy approximately 210 condensed hectares. - The estimated mean water use of $9.2 \times 10^5 \text{ m}^3/\text{year}$ implies that <i>A. mearnsii</i> reduces steam flow of Mkomazi basin by 0.14%. - The estimated amount of money needed to control <i>Acacia mearnsii</i> in Chome Nature Reserve is TZS 164.64 Million	Although <i>Acacia mearnsii</i> is widely used for tannin and fuel wood, it is not desirable in riparian and forest reserves therefore management should be practiced now before to prevent further spread.

Appendix 4: A summary of reviewed policies, legal frameworks, strategies and ratified multilateral agreements

S/N	Policy & legal framework category	Section of Relevancy	Degree of relevancy to Invasive species	Recommendations
National Policies				
1	National Environmental Policy (1997)	Sect. 12 (d) Informs on wildlife habitat loss that threaten the national heritage and creation of an uncertain future for the tourist industry; Sect. 18 (c) calls for conservation and enhancement of our natural and man-made heritage including the biological diversity of unique ecosystem of Tanzania	Partially addressed	The policy should (i) Introduce invasive species as a matter of concern (ii) state the responsibility of any developmental project on issues pertaining to alien/invasive species (no introduction), (iii) state clearly issues on all the four stages of IS management (prevention, eradication, control and restoration)
2	National Forest Policy (1998)	Sect. 4.1.1 Informs about damage by diseases and pests of exotic wood species resulting into reduced stock and wood quality; Sect. 4.1.3 Informs on the increased promotion of exotic species planting compared to native species	Not addressed	(i) There should be a comprehensive section detailing on issues pertaining to invasive species management (ii) should detail on protection of forestlands from exotic/alien/ native invasive species as a collective responsibility (iii) Should include a section that promote reforestation by using native species rather than exotic/alien species
3	National Fisheries Policy (2015)	Sect. 3.2 (v) Provides for protection of critical habitats to enhance fish reproduction and therefore fisheries sustainability; Sect. 3.6 (iii-iv) Provides for regulation of the quality of aqua feeds and seeds; and control of fish diseases and escapees	Not addressed	The policy should further enlighten on the following: (i) Protection of fish and their habitats from exotic/alien/native invasive species (ii) state the responsibility of every stakeholder on issues pertaining to invasive species management, (iii) state clearly issues on the management of invasive species
4	National Land Policy (1997)	Sect. 6.10.1(iii) Informs on village land use plans in guiding for extension services including wildlife, forestry, fisheries and environmental conservation Sect. 7.7.1 calls for establishing Coastal Zone Integrated Development and Management Programme for conservation of both land and aquatic environments	Not addressed	The policy should: (i) Define native, exotic/alien and invasive species (ii) Strictly prohibit introduction of exotic/alien species (iii) State on eradication and control/management approaches once an introduction has occurred (iv) Provide for a section on collective responsibility in fighting exotic/invasive species (vi) Should insist on the formulation of a national regulation that will address the management of alien and invasive species

S/N	Policy & legal framework category	Section of Relevancy	Degree of relevancy to Invasive species	Recommendations
5	National Livestock Policy (2006)	Sects. 3.11.1-2 Informs on animal health services and control of trans-boundary animal diseases of economic importance	Partially addressed	The policy should provide (i) a comprehensive section detailing on issues pertaining to invasive species management (ii) should detail on protection of native livestock from exotic/alien/ and native invasive species as a collective responsibility (iii) A section that require for a detailed research on invasive livestock (animals)
6	National Agriculture Policy (2013)	Sect. 3.1.3 (iii) Provides for support for any initiatives that aim at addressing agro-biodiversity deterioration; Sect. 3.3.3 (iv) Provides for protection in a sustainable way such that, the productivity potential of crop germ-plasm and related biodiversity in the existing agro-ecosystem is not endangered by the introduction of genetically engineered plants; Sect. 10 State general control of pest and diseases; Sect. 3.10.3 state on strengthening surveillance system and sanitary and phyto-sanitary and plant inspectorate services	Partially addressed	The policy do not address enough exotic/alien/ invasive species issues, it should (i) provide a section for protection of farmland/ rangelands from exotic/alien invasive species (ii) clearly state on issues regarding importation of exotic/alien seeds for agricultural use (iii) should call for all agricultural sectors Acts and Regulations to conduct exotic/alien/ invasive species management
7	Wildlife Policy (1998)	Sect. 3.3.3 (vii) Informs on regulating the importation of exotic/alien species and re-introduction of a species known to be indigenous to the area in order to safeguard against negative effects resulting from their introduction and reintroduction into the wild	Partially addressed	The policy only addresses prevention stage of IS management, therefore (i) Review of the policy to also address eradication, control and restoration stages of IS management should be done. (ii) Mainstream IS management issues into the Wildlife Management Act.
8	The National Policies for Tanzania National Parks (2011)	Sect. 3.7 (3.7.7) Defines what exotic species are, and prohibits introduction of new exotic species. It provides for control including eradication of exotic species wherever such species threaten/ impacts on park resources or public health and when control is feasible	Fully addressed	The policy should (i) address on the control of native invasive species (ii) Issues regarding alien invasive species management addressed by this policy needs to be included under the National Parks Act
9	Construction Industry Policy (2003)	Sect. 3.5.3. Insists on sound environmental management including but not limited to: undertaking of Environmental Impact Assessment for all developmental projects, environmental awareness in relation to people, land and wildlife	Partially addressed	There should be a complete section that address solely on invasive species management as this sector has a direct connection with activities such as construction and importation that are directly linked to alien invasive species introduction

S/N	Policy & legal framework category	Section of Relevancy	Degree of relevancy to Invasive species	Recommendations
10	National Transport Policy (2016)	No relevant section addressing Alien/ invasive species	Not addressed	(i) There should be a comprehensive section detailing on issues pertaining to invasive species management (ii) should detail on protection of forestlands from exotic/alien/ native invasive species as a collective responsibility (iii) Should include a section that promote reforestation by using native species rather than exotic/ alien species
National Acts				
1	Environmental Management Act (2004)	Sect.67(2)(h) Informs on the prevention and eradication of alien species Sect.229(1)(b) Informs on the preparation of guidelines	Fully addressed	The ministry should (i) ensure Regulations and bylaws that address on alien / invasive species are formulated and enforced (ii) should state the responsibility of any project team to ensure no introduction of alien/ invasive plants (ii) state modalities to ensure that penalties assigned to any project that contravenes the section are effected (iv) Should put in place procedures for monitoring projects compliance with the regulation section(s) (v) should enquire ecologist/weed/invasive species expert recommendation on any project that is associated with the environment (vi) should ensure formulation of alien and invasive species Regulations and guidelines
2	Forest Act (2002)	Sect. 18 (1-2) EIA for projects with potential of introducing invasion such as mining, road and dam construction, agriculture/ horticulture/ aquaculture	Not addressed	(i) There should be a comprehensive section detailing on issues pertaining to invasive species (management/ containment etc.) (ii) should detail on protection of forestlands from exotic/alien/ native invasive species as a collective responsibility (iii) Should ensure compliance with the law by stating penalties to whoever caused introduction of exotic/alien species (iv) it should acknowledge the Environmental Management Act

S/N	Policy & legal framework category	Section of Relevancy	Degree of relevancy to invasive species	Recommendations
3	Fisheries Act No 22 of 2003	Sect.13 State on restriction of eggs, seed, exotic adult fish without permission; Sect. 17(k) state on controlling of importation of fish and introduction of exotic species	Fully addressed	The Act should address the following issues: (i) Formulation of procedures for regulating the importation of exotic/alien fish species (ii) state modalities to ensure that penalties assigned to any stakeholder who contravenes the section are effected (iii) Should put in place procedure for monitoring stakeholder's compliance with the regulation section(s). The Act should equally strategize on controlling native invasive species should there be such an invasion.
4	Land Act CAP 113 (1999)	No relevant section on alien/ invasive species	Not addressed	The Act should: (i) Define exotic/alien invasive species (ii) Strictly prohibit introduction of exotic/alien species (iii) State on the control/management approaches once an introduction has occurred (iv) Provide for a section on collective responsibility in fighting exotic/invasive species
	Village Land Act No. 5 of 1999	Sect. 6.-(1) Declaration of hazard land (3), hazard land is land the development of which is likely to pose a danger to life or to lead to the degradation	Not addressed	The Act should: (i) Define exotic/alien species (ii) Strictly prohibit introduction of exotic/alien species (iii) State on the control/management approaches once an introduction has occurred (iv) State on the penalties to whoever caused introduction of exotic/alien species (v) Ensure compliance with the law (vi) Should insist on the formulation of regulation and rules for the management of invasive species
5	Grazing Land and Animal Feeding Resources Act No. 13 of 2010	Sect. 37 (c) For the purpose of protecting a grazing land, the policy requires formulation of by-laws on introduction or removal of flora or fauna	Partially addressed	There should be (i) a comprehensive section addressing solely on issues pertaining to invasive species (management/containment etc.) (ii) should state the responsibility of stakeholders in ensuring no introduction of alien/ invasive species (vi) state modalities to ensure that penalties assigned to any stakeholder who contravenes the section are effected (v) Should put in place procedure for monitoring stakeholders compliance with the Act

S/N	Policy & legal framework category	Section of Relevancy	Degree of relevancy to Invasive species	Recommendations
	The Animal Diseases Act (2003)	Sect. 43.- No person shall(b) move an animal or animal products or animal wastes from outside of the country or introduce animals into any area without a permit. Sect. 45. (1) Migrating herds, trade livestock shall be controlled at obligatory border post and internal check points where official Veterinary inspection shall be carried out.58. The Minister may after consultation with the Minister responsible for wildlife, make regulations relating to the introduction and spread of exotic and natural bee diseases and by such regulations- (a) regulate and monitor the introduction including the importation of exotic bees from other countries which may carry bacterial, viral, parasitic and fungal infections that will affect natural honey bee colonies	Fully addressed	Needs to be implemented effectively. It should also acknowledge the Environmental Management Act.
6	Plant Protection Act No. 13 of 1997	Sect.3. The Minister may make rules for the purposes of preventing and controlling attacks by or the spread of harmful organisms or diseases in Tanzania Sect. 8.2. Any plant or plant product, harmful organism, beneficial organism, or soil imported into Tanzania, shall be clearly identified, declared to an inspector and be made available for an inspection or any subsequent action provided by this Act. Sect 13.-(1) Subject to sub-section (2) of this section, anything imported into Tanzania contrary to this Act shall be seized by an inspector, and, at the importer's expense, be treated, destroyed; or may be taken to a post-entry quarantine station for such further inspection, treatment and disposal as may be required.	Fully addressed	The Act (i) covers control of pest and disease in general including alien invasive species (ii) Guidelines should be developed to make implementation easy (iii) Implementation and capacity is required

S/N	Policy & legal framework category	Section of Relevancy	Degree of relevancy to Invasive species	Recommendations
7	Seed Act (2003)	Sect. 13(2) The Director shall, before granting the permit or license required under subsection (1) ensure that the standards and conditions for seed importation, production, processing, distribution sale or advertisement for sale, as provided for in the Plant Protection Act and in this Act, have been complied with	Partially addressed	The Act should: (i) Define exotic/alien species (ii) Strictly prohibit introduction of exotic/alien species (iii) for Penalties, it should refer to the proposed Environmental Management of Alien and Invasive Species Regulation above (under Environmental Management Act)
	Tanzania Agricultural Research Institute Act (2016)	3rd Schedule (a-d), Research should focus on: - Integrated Pest Management; Weeds and invasive species management and any other emerging issues	Fully addressed	There is a need for effective regulation and rules that align with both the National Agriculture Policy and Tanzania Agricultural Research Institute Act to be formulated for effective implementation of both the Policy and the Act
	Wildlife Conservation Act No. 5 of 2009	Sect.35(1-3) The prospective developer shall prepare and submit to the satisfaction of the Minister responsible for Environment a report on Environmental Impact Assessment (EIA) of the proposed development; Sect.35(5) (a). The EIA shall provide a statement of the existing or anticipated economic impacts to the conservation of wildlife, including an account of the species, communities and habitats affected and the extent to which they are or may be threatened;	Partially addressed	The Act should (i) Have a comprehensive section addressing solely on alien/invasive species as a matter of concern and direct on IS prevention, eradication, control and restoration of impacted ecosystems (ii) Formulate procedures for regulating the importation of exotic/alien species and re-introduction of a species known to be indigenous to the area (iii) state modalities to ensure that penalties assigned to any development/project that contravenes the section are effected (iv) Should put in place procedures for monitoring development/projects compliance with the regulation section(s) in order to safeguard against negative effects resulting from their introduction and reintroduction into the wild (v) in the definition of terms, redefine 'wildlife' to exclude "established exotic species", instead, use such words as "naturalized exotic species".

S/N	Policy & legal framework category	Section of Relevancy	Degree of relevancy to Invasive species	Recommendations
8	The National Parks Act No. 11, 2003	Sect. 29(4) Informs that, the Introduced vegetation to be destroyed or dealt with accordingly	Partially addressed	The act needs to address issues as raised in the National Policies for Tanzania National Parks (2011) as follows: (i) Define exotic/alien species (ii) Strictly prohibit introduction of exotic/alien species (iii) State on the control/management approaches once an introduction has occurred (iv) State on the penalties to whoever caused introduction of exotic/alien species (v) Define invasive species and their management approaches (vi) Ensure compliance with the law (vii) Should insist on the formulation of regulation and rules for the management of invasive species
9	The Contractors Registration Act (1997)	No relevant section on alien/ invasive species	Not addressed	The Act should: (i) Define exotic/alien invasive species (ii) Strictly prohibit introduction of exotic/alien species (iii) State on the control/management approaches once an introduction has occurred (iv) Provide for a section on collective responsibility in fighting exotic/invasive species
10	Surface and Marine Transport Regulatory Authority Act (2001)	Sect. 5.(f)It shall be the duty of the Authority that in carrying out its functions it shall strive to enhance the welfare of Tanzania society by(f) taking into account the need to protect and preserve the environment.	Partially addressed	The Act should: (i) Define exotic/alien species (ii) Strictly prohibit introduction of exotic/alien species (iii) for Penalties, it should refer to the proposed Environmental Management Alien and Invasive Species Regulation above (under Environmental Management Act)
	Merchant Shipping Act No. 21 of 2003	Sect. 253 (2)(h) requiring information relating to the stability of any ship to which freeboards are assigned, and the loading and ballasting of any ship, as may be specified by the regulations provided for the guidance of the master of the ship.	Not addressed	The Act (i) should incorporate exotic/alien species issues (ii) Strictly prohibit introduction of exotic/alien species through shipping (iii) State on the control/management approaches once an introduction has occurred (iv) State on the penalties to whoever caused introduction of exotic/alien species (v) Ensure compliance with the law (vi) it should acknowledge the Environmental Management Act

S/N	Policy & legal framework category	Section of Relevancy	Degree of relevancy to Invasive species	Recommendations
	Tanzania Civil Aviation Act (2006)	Sect. 25. It shall be the duty of the Authority that in carrying out its functions it shall strive to enhance the welfare of Tanzania society by: (f) taking into account the need to protect and preserve the environment	Partially addressed	The Act (i) should be revised to address exotic/ alien invasive species (ii) should set penalties to whoever unlawful found in possession of exotic species (seed, live or germ-plasm) (iii) should ensure penalties are duly paid (iv) should ensure compliance with the law at all entry points (ports, airports and borders) (v) it should acknowledge the Environmental Management Act
11	Deep Sea Fishing Authority Act (1998)	No relevant section on alien/ invasive species	Not addressed	The Act should: (i) Define exotic/alien invasive species (ii) Strictly prohibit introduction of exotic/alien species (iii) State on the control/management approaches once an introduction has occurred (iv) Provide for a section on collective responsibility in fighting exotic/invasive species
National Regulations				
1	The Environmental Impact Assessment and Audit Regulations (2005)	Sect. (1) (v, vi, VII) Informs on EIA undertaking for the projects that involves : Biological Pest Control; Introduction of new breeds of crops; and Introduction of Genetically Modified Organisms (GMOs) Projects. Sect. 2. (ii) and (iii) Introduction of new breeds of livestock and foreign alien species projects.	Fully addressed	(i) Enforcement is required in the implementation of various project which EIA is a Mandatory. Awareness raising is important for the control and management of alien and invasive species (ii) Formulation of Alien and Invasive Species Regulation is crucial
	The Environmental Management (Bio-safety) Regulations (2009)	The regulation is dealing with the issues of GMOs	Not addressed	To align with the Environmental Management Act (2004), the regulation (i) should have a specific section detailing on exotic/alien invasive species (ii) should state the responsibility of stakeholders in ensuring no introduction of alien/ invasive species (iii) state modalities to ensure that penalties assigned to any stakeholder who contravenes the section are practiced (iv) Should put in place procedure for monitoring stakeholders compliance with the regulation

S/N	Policy & legal framework category	Section of Relevancy	Degree of relevancy to Invasive species	Recommendations
2	Tanzania Forest Regulation (2004)	Sect 19: Informs on the responsibility of the Director to establish restrictions on activities related to introduction of a biological resource that is likely to cause among other effects; environmental impacts which are undesirable or difficult to control	Partially addressed	(i) There should be a comprehensive section detailing on issues pertaining to invasive species management/containment (ii) should detail on protection of forestlands from exotic/alien/ native invasive species as a collective responsibility (iii) Should ensure compliance with the law by stating penalties to whoever caused introduction of exotic/alien species (iv) Should insist on the formulation of regulation and rules for the management of invasive species in forestlands (v) should detail on protection of forestlands from exotic/alien/ native invasive species as a collective responsibility (vi) Should include a section that promote native species restoration rather than planting exotic/ alien species (vii) it should acknowledge the Environmental Management Act
3	Fisheries Regulation (2009)	Sect. 25 (1) No person shall, without obtaining a written permit or other authorization from the Director and except in accordance with the conditions specified in the permit or other authorization: (a) import any live fish or aquatic flora into the country	Partially addressed	To align with the National Fisheries Policy (2015) and Fisheries Act No 22 of 2003, the regulation should focus on the following: (i) Protection of fish and their habitats from exotic/alien/ native invasive species (ii) state the responsibility of every stakeholder on issues pertaining to alien/ invasive species (no introduction), (iii) state clearly issues on the management of invasive species (iv) state modalities to ensure that penalties assigned to any stakeholder who contravenes the regulation are effected (iv) it should acknowledge the Environmental Management Act
4	Village Land Regulation (2001)	No relevant section on exotic/ invasive species	Not addressed	The regulation should: (i) Define exotic/alien invasive species (ii) Strictly prohibit introduction of exotic/ alien species (iii) State on the control/management approaches once an introduction has occurred (iv) Provide for a section on collective responsibility in fighting exotic/invasive species (v) state penalties to individuals who contravenes with the regulation (vi) state modalities to ensure that penalties assigned to any stakeholder who contravenes the regulation are effected (vii) it should acknowledge the Environmental Management Act

S/N	Policy & legal framework category	Section of Relevancy	Degree of relevancy to Invasive species	Recommendations
5	The Animal Diseases (Appointment and Duties of Inspectors) Regulations, 2005	Objective 4(i): Aims keeping exotic animal / zoonotic diseases out of Tanzania	Partially addressed	The regulation should: (i) Define exotic/alien invasive species (ii) Strictly prohibit introduction of exotic/alien species (iii) State on the control/management approaches once an introduction has occurred (iv) Provide for a section on collective responsibility in fighting exotic/invasive species (v) state penalties to individuals who contravenes with the regulation (vi) state modalities to ensure that penalties assigned to any stakeholder who contravenes the regulation are effected (vii) it should acknowledge the Environmental Management Act
	Grazing-Lands and Animal Feed Resources (Pasture Management Practices) Regulations, 2012	S(1)(c) and 5 th schedule requires the rangeland owner to Weed the grazing-land where applicable	Partially addressed	The regulation should: (i) Define exotic/alien invasive species (ii) Strictly prohibit introduction of exotic/alien species into rangelands (iii) State on the control/management approaches once an introduction has occurred (iv) Provide for a section on collective responsibility in fighting exotic/invasive species (v) state penalties to individuals who contravenes with the regulation (vi) state modalities to ensure that penalties assigned to any stakeholder who contravenes the regulation are effected (vii) it should acknowledge the Environmental Management Act
	The Grazing-lands and Animal Feed Resources (Safeguarding, Development and Sustainable Use of Grazing-lands) Regulations, 2012	No relevant section on invasive and exotic plant species	Not addressed	The regulation should: (i) Define exotic/alien invasive species (ii) Strictly prohibit introduction of exotic/alien species (iii) State on the control/management approaches once an introduction has occurred (iv) Provide for a section on collective responsibility in fighting exotic/invasive species (v) state penalties to individuals who contravenes with the regulation (vi) state modalities to ensure that penalties assigned to any stakeholder who contravenes the regulation are effected (vii) it should acknowledge the Environmental Management Act

S/N	Policy & legal framework category	Section of Relevancy	Degree of relevancy to Invasive species	Recommendations
6	The Plant Protection Regulations (1998)	Sect 13.- Declaration on arrival (1) The declaration to an inspector of any plant, plant products, soil, or plant protection substance imported into Tanzania as required by the Act. Sect. 48 (1) Subject to the provisions of the Act and these Regulations, no person shall import plant or plant products except in accordance with the conditions on a plant importation permit previously obtained from, and signed by the Inspector in-charge.	Fully addressed	This regulation is comprehensive document for phytosanitary and quarantine measures, it should be strictly implemented for country protection against alien invasive species. Capacity at entry point for early detection should be strengthened
	The Seeds Regulations (2007)	Sect. 33(4) Any seed imported under this regulation shall not be sold unless its quality has been examined and approved by TOSCI or any other certification agency which is in bilateral agreement with Tanzania as regard to seed certification. Sect. 33 (5) Any imported seed shall be accompanied by certificate of quality issued by a Recognized Certification Agency, phyto-sanitary certificate and shall meet Tanzanian quarantine requirements as provided in the Plant Protection Act	Fully addressed	The regulation (i) should have a specific section detailing on exotic/alien invasive species (ii) should state the responsibility of stakeholders in ensuring no introduction of alien/ invasive species (iii) need to be fully implemented (iv) it should acknowledge the Environmental Management Act
7	Wildlife Conservation (Wildlife Management Areas) Regulation (2018)	S. 51. Prohibit introduction or re-introduction of non-indigenous of wildlife, bees, trees or fish in wildlife management areas unless a written approval of a competent authority in accordance with written laws is obtained.	Fully addresses	The regulation (i) should have a specific section detailing on exotic/alien invasive species (ii) should state the responsibility of stakeholders in ensuring no introduction of alien/ invasive species (iii) need to be fully implemented (iv) it should acknowledge the Environmental Management Act

S/N	Policy & legal framework category	Section of Relevancy	Degree of relevancy to Invasive species	Recommendations
8	Non-Consumptive Utilization Regulations 2007	No relevant section on exotic/ invasive species	Not addressed	The regulation should: (i) Define exotic/alien invasive species (ii) Strictly prohibit introduction of exotic/alien species (iii) State on the control/management approaches once an introduction has occurred (iv) Provide for a section on collective responsibility in fighting exotic/invasive species (v) state penalties to individuals who contravenes with the regulation (vi) state modalities to ensure that penalties assigned to any stakeholder who contravenes the regulation are effected (vii) it should acknowledge the Environmental Management Act
9	The Railways (Handling and Transportation of Dangerous Goods) Regulations (2008)	Sect. 27 (1) Miscellaneous dangerous substances and articles shall include, inter alia: a) environmentally hazardous substances; b) elevated temperature substances; c) Genetically Modified Micro-Organisms or Genetically Modified Organisms which do not meet the definition of infectious substances but which are capable of altering animals, plants or microbiological substances in a way not normally the result of natural reproduction	Partially addressed	The regulation should: (i) Define exotic/alien species (ii) Strictly prohibit introduction of exotic/alien species (iii) it should acknowledge the Environmental Management Act
	Merchant Shipping (Ship and Port facility security) regulations (2004)	No relevant section on alien/ invasive species	Not addressed	The regulation (i) should incorporate exotic/alien species issues (ii) Strictly prohibit introduction of exotic/alien species through shipping (iii) State on the control/management approaches once an introduction has occurred (iv) State on the penalties to whoever caused introduction of exotic/alien species (v) Ensure compliance with the law (vi) Should insist on the formulation of guidelines and rules for the management of invasive species in seas an oceans
	The Tanzania Civil Aviation Ground Handling Services Regulations, 2007	S. 22 Requires ground handling service provider shall take the necessary measures to ensure protection of the environment	Partially addressed	The regulation should: (i) Define exotic/alien species (ii) Strictly prohibit introduction of exotic/alien species (iii) it should acknowledge the Environmental Management Act

S/N	Policy & legal framework category	Section of Relevancy	Degree of relevancy to Invasive species	Recommendations
10	Deep Sea Fishing Authority Regulations (2009)	No relevant section on alien/ invasive species	Not addressed	The regulation (i) should incorporate exotic/alien species issues (ii) Strictly prohibit introduction of exotic/ alien species through shipping/ fishing (iii) State on the control/management approaches once an introduction has occurred (iv) State on the penalties to whoever caused introduction of exotic/alien species (v) Ensure compliance with the law (vi) Should insist on the formulation of guidelines and rules for the management of invasive species in seas an oceans
National and Regional Strategies				
1	Strategy on Urgent Actions for the Conservation of Marine and Coastal Environment, Lakes and Rivers Ecosystems and Dams (2008)	Informs on; prevention of introduction, control or eradication of alien species which threaten aquatic ecosystems and habitats	Fully addressed	Implementation is required. It should be complimented by the Marine Parks and Reserves Act No. 29 of 1994 by adding section on the Act that address exotic/alien/ invasive species as suggested above (Marine Parks and Reserves Act No. 29 of 1994)
2	National Biodiversity Strategy and Action Plan (2015-2020)	Strategic goal B, target 6: By 2020, at least three Legislations that govern exploitation of aquatic and terrestrial resources are reviewed and enforced target 9: By 2020 invasive alien species and pathways are identified and prioritized, priority species are controlled or eradicated, and measures are in place to prevent their introduction and establishment	Fully addressed	Implementation for listed priority actions for intervention (page 120) which include to review and implement relevant national policies and legislation to address issues of Invasive Alien Species by 2020, Conducting inventory of exotic invasive species by 2018 and all other listed priority actions (Table 7-1, Target 9, page 120) need to be mainstreamed at all levels and Implemented accordingly (ii) be complimented strongly by the Marine Parks and Reserves Act No. 29 of 1994, the Wildlife Conservation Act No. 5 of 2009, the Forest Act 2002, The National Parks Act No. 11 of 2003, Ngorongoro Conservation Area Ordinance No 413 of 1959 and the Environmental Management Act of 2004 by adding sections on the Acts that address exotic/alien/invasive species as suggested

S/N	Policy & legal framework category	Section of Relevancy	Degree of relevancy to invasive species	Recommendations
3	Strategy on Urgent Actions on Land Degradation and Water Catchments (2006)	Identified 12 problems on land degradation and water catchments and their implementation strategies	Not addressed	The strategy needs (i) to address exotic/alien/invasive as it is among the causes of land and water catchments degradation (ii) to be strongly complemented by the Marine Parks and Reserves Act No. 29 of 1994, Water Resource Management Act No. 11 of 2009, the Village Land Act No. 5 of 1999, the Environmental Management Act of 2004 by adding sections on the Acts that address exotic/alien/invasive species as suggested
4	Agriculture sector Development Strategy (2016-2025)	IR 4.4 (a). State on early warning system and pest and disease surveillance system for early detection of disaster; (e) Strengthening collaboration with regional and international organization for early detection on migratory disease and pest from neighboring country	Partially addressed	The strategy need (i) to be reviewed to address issues of exotic/alien/invasive species control and management (ii) to be strongly complemented by Plant Protection Act No. 13 of 1997 and Tanzania Agricultural Research Institute Act of 2016
5	The Tanzania Development Vision 2025	Targets 3.3: State that, The fast growth of the competitive economy will be persuade while effectively reversing current adverse trends in the loss and degradation of Environmental Resources (such as Forests, Fisheries, Fresh water, Climate, Soils, Biodiversity and the accumulation of hazardous substances"	Partially addressed	The vision need (i) to address issues of exotic/alien/invasive species control and management (ii) to address effects of alien and invasive species on development
6	Tanzania National Five Year Development Plan 2016/17 – 2020/21	Sect. 4.2.6 (i) (c) Protecting, restoring and promoting sustainable use of terrestrial ecosystems; sustainably managing forests, combating desertification, and halting and reversing land degradation and halting biodiversity loss. (ii) (b) Enforcement of environmental impact assessments (EIAs), Strategic Environmental Impact Assessments (SEIAs) and other environmental laws.	Partially addressed	The plan need (i) to address issues of exotic/alien/invasive species control and management (ii) to address effects of alien and invasive species on development

S/N	Policy & legal framework category	Section of Relevancy	Degree of relevancy to Invasive species	Recommendations
7	SADC Regional biodiversity strategy	Sect. 2.3.7 (b) SADC Biodiversity Support Programme. Its objective is to enhance and/or establish capacity and institutional mechanisms that enable Member States to collaborate in regional biodiversity conservation; to prevent and control the spread of Invasive Alien Species; and to apply Access and Benefit Sharing principles	Full addressed	Need for adoption and implementation on prevention, eradication and control measures of alien invasive species
Ratified Multilateral Agreements				
1	Convention on Biological Diversity (1996)	Article 8 (h), Each contracting party shall as far as possible and as appropriate prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats or species	Fully addressed	Implementation of its adoption from Aichi agreement by NBSAP needs to be implemented and channeled accordingly
2	International Plant Protection Convention (1951)	Article I(1). With the purpose of securing common and effective action to prevent the spread and introduction of pests of plants and plant products, and to promote appropriate measures for their control. The IPPC provides an international framework for plant protection that includes developing International Standards for Phytosanitary Measures (ISPMs) for safeguarding plant resources. ISPMs developed as of 31 July 2009 include standards for: pest surveillance, survey and monitoring, import regulations and pest risk analysis, compliance procedures and phytosanitary inspection methodologies, post entry quarantine and exotic pest emergency response, control and eradication	Fully addressed	Implementation is required (i) IPPC communication channel for early warning on pests i.e. presence of focal points/persons needs to be adopted by relevant sectors (ii) be complimented strongly by Plant Protection Act No. 13 of 1997 and other relevant legal frameworks by adding sections on the Acts that address exotic/alien/invasive species as suggested
3	United Nations Framework Convention on Climate Change (1992)	To mitigate and adapt to climate change to ensure sustainable food production as well as sustainable development	Not addressed	Need to (ii) include a comprehensive section addressing solely on issues pertaining to invasive species (management/containment etc) (ii) be complimented strongly by the Environmental Management Act of 2004 and other relevant legal frameworks by adding sections on the Acts that address exotic/alien/invasive species as suggested

S/N	Policy & legal framework category	Section of Relevancy	Degree of relevancy to Invasive species	Recommendations
4	The United Nations Convention to Combat Desertification (1996)	To combat desertification and reduce effects of droughts in countries experiencing serious drought and/or desertification, particularly in Africa	Not addressed	Need to (ii) include a comprehensive section addressing solely on issues pertaining to invasive species as an environmental shock (ii) be complimented strongly by the Environmental Management Act of 2004 and other relevant legal frameworks by adding sections on the Acts that address exotic/alien/invasive species as suggested
5	Ramsar Convention on Wetlands (1975)	Informs conservation and wise use of wetlands and their resources	Partially addressed	Need to (ii) include a comprehensive section addressing solely on issues pertaining to invasive species (management/containment, etc.) (ii) be complimented strongly by the Environmental Management Act of 2004 and other relevant legal frameworks by adding sections on the Acts that address exotic/alien/invasive species as suggested
6	UNESCO World Heritage Convention) Convention for Protection of World Cultural and Natural Heritage (1972)	Informs of the establishment of an effective system for the collective protection of cultural and natural heritage of outstanding universal value	Partially addressed	Need to be revised to (ii) include a comprehensive section addressing solely on issues pertaining to invasive species (management/containment etc) (ii) be complimented strongly by other relevant legal frameworks by adding sections on the Acts that address exotic/alien/invasive species as suggested
7	Convention on International Trade in Endangered Species of Wild Fauna and Flora (1975)	International trade in specimens of wild animals and plants does not threaten the species' survival.	Partially addressed	Need to be revised to (ii) include a comprehensive section addressing solely on issues pertaining to invasive species (management/containment etc) (ii) Section for handling species that are endangered but potentially invasive (iii) be complimented strongly by other relevant legal frameworks by adding sections on the Acts that address exotic/alien/invasive species as suggested
8	Convention on Sustainable Management of Lake Tanganyika (2003)	Sect. 10(1)(b). to prevent the introduction of, control and eradicate exotic species that threaten ecosystems, habitats or species and the genetic resources that form part of the Lake Basin.. to prevent the deliberate or accidental introduction of species into areas of the Lake Basin in which they do not naturally occur	Fully addressed	Implementation is required, should be aligned with (i) the Environmental Management Act of 2004 and other relevant Acts by adding sections on the Acts that address exotic/alien/invasive species as suggested (ii) Guidelines for early detection, prevention, control, awareness creation and capacity building for exotic/invasive species should be formulated

S/N	Policy & legal framework category	Section of Relevancy	Degree of relevancy to Invasive species	Recommendations
9	Convention Concerning the Protection of the World Cultural and Natural Heritage (The World Heritage Convention) (1972)	Establish an effective system for the collective protection of cultural and natural heritage of outstanding universal value	Partially addressed	Need to be updated to (i) include a comprehensive section addressing solely on invasive species as among the threats to World cultural and Natural heritage (ii) Should provide guidelines for early detection, prevention, control, awareness creation and capacity building for exotic/invasive species (iii) be complimented strongly by other relevant legal frameworks by adding sections on the Acts that address exotic/alien/invasive species as suggested
10	WTO Sanitary and Phyto-sanitary Agreement	Article 2(1) Members have the right to take sanitary and phyto-sanitary measures necessary for the protection of human, animal or plant life or health, provided that such measures are not inconsistent with the provisions of this Agreement	Fully addressed	Our regulation should adopt fully the issue of sanitary and phyto-sanitary to address alien and invasive species
11	SADEC Protocol on Wildlife Conservation and Law Enforcement of 1999	The protocol is silent on invasive species	Not addressed	Review of the protocol is imminent so as to address issues pertaining to exotic/ invasive species, the reviewed protocol should align with Wildlife Conservation policy, regulations and other relevant regulations to address exotic/alien/invasive species as recommended above
12	Lusaka Agreement on Cooperative Enforcement Cooperation Directed at Illegal Trade of Wild Fauna and Flora 1994	General conservation of wild fauna and flora	Partially addressed	The protocol should be reviewed so as to address issues pertaining to exotic/ invasive species (ii) should include a section on collective responsibility in combating exotic/ invasive species (iii) the reviewed protocol should align with Wildlife Conservation policy, regulations and other relevant regulations to address exotic/alien/invasive species as recommended above
13	The Agreement of the Conservation of African-Eurasian Migratory Water Birds (AEWA) (1999)	Annex 3: (4) 4.3.11 State on parties to take measures to tackle threats to migratory water birds on other things including environmental assessment for developments that threaten wetlands of importance for water birds, introduction of non-native and potentially invasive species	Fully addressed	Needs to be implemented by addressing exotic/ invasive species in all relevant policy and legal frameworks as suggested under policy, Acts and regulation fields above

S/N	Policy & legal framework category	Section of Relevancy	Degree of relevancy to Invasive species	Recommendations
14	The Cartagena Protocol on Bio-safety (2003)	Article 8. 1. The Party of export shall notify, or require the exporter to ensure notification to, in writing, the competent national authority of the Party of import prior to the intentional transboundary movement of living modified organisms. Article 14. Parties may enter into bilateral, regional and multilateral agreements and arrangements regarding intentional transboundary movements of living modified organisms. Article 17. Each Party shall take appropriate measures to notify affected or potentially affected States, when it knows of an occurrence under its jurisdiction resulting in a release that leads, or may lead, to an unintentional transboundary movement of a living modified organism that is likely to have significant adverse effects on the conservation and sustainable use of biological diversity, taking also into account risks to human health in such States. Other article, 12, 15, 16	Partially addressed	The protocol should be revised so as to also include issues pertaining to exotic/ invasive species (ii) should include a section sections on collective responsibility in combating exotic/invasive species (iii) the revised protocol should align with other available relevant policies and legal frameworks under different sector/ institutions
15	The convention on the Prevention of Marine Pollution from ships (MARPOL) (1975)	Regulation 10, page 81 Oil tankers entering special areas for the purpose of loading shall make every effort to enter the area with only clean ballast on board Page 245 (6). The discharge into the sea of substances which have not been categorized, provisionally assessed or evaluated as referred to in regulation 4 (1) of this Annex, or of ballast water, tank washings, or other residues or mixtures containing such substances shall be prohibited	Partially addressed	The convention should also address exotic/ invasive species marine pollution from ships by including a section/ sections that will task parties to ensure no introduction of exotic/ invasive species. The convention agreement should be complemented by existing relevant policy and legal frameworks

S/N	Policy & legal framework category	Section of Relevancy	Degree of relevancy to Invasive species	Recommendations
16	The United Nations Convention on Law of the Sea, Montego Bay (1994)	Article 196 .1. States shall take all measures necessary to prevent, reduce and control pollution of the marine environment resulting from the use of technologies under their jurisdiction or control, or the intentional or accidental introduction of species, alien or new, to a particular part of the marine environment, which may cause significant and harmful changes thereto	Fully addressed	Implementation is required (i) it should be complimented strongly by The National Parks policy and legal frameworks, Marine Parks and Reserves Act No. 29 of 1994, The Surface and Marine Transport Regulatory Authority Act 2001 and other relevant legal frameworks by adding sections on the Acts that address exotic/alien/invasive species as suggested (ii) Relevant regulations should ensure compliance with the law by stating penalties to whoever caused introduction of exotic/alien species
17	Merchant Shipping (Ballast Water Management Convention) Regulations, 2017	Sect. 5-11 Provides for Ballast water management Plan; Ballast water record Book; Ballast water discharge; exchange; Treatment; and Discharge to reception facilities	Not addressed	It should be complimented strongly by the Marine Parks and Reserves Act No. 29 of 1994, the Surface and Marine Transport Regulatory Authority Act 2001 and other relevant legal frameworks by adding sections on the Acts that address exotic/alien/invasive species as suggested (ii) Relevant regulations should ensure compliance with the law by stating penalties to whoever caused introduction of exotic/alien species

Appendix 5: A list of consulted individuals and their organizations

S/No.	List of stakeholders	Location	Mode of information gathering
1.	LVEMPII – Lake Victoria Environmental Management Project	Mwanza	Visit
2.	ECHO Tanzania	Arusha	Visit
3.	Tropical Pesticides Research Institute	Arusha	Questionnaires
4.	Woody Weeds Project (CABI)	Moshi	Visit
5.	Ngorongoro Conservation Area Authority	Ngorongoro	Visit
6.	Ngorongoro District Council	Ngorongoro	Visit
7.	National Biological Control Unit	Kibaha	Visit
8.	Tanzania National Park (All)	Meru	Questionnaires
9.	Kongwa District Council	Kongwa	Visit
10.	Amani Nature Reserve	Muheza	Visit
11.	Serengeti District Council	Serengeti	Visit
12.	Marine Parks Authority	Dar es Salaam	Visit
13.	Mweka Wildlife college	Kilimanjaro	Questionnaires
14.	Plant health service (PHS)- MOA	Dodoma	Questionnaires
15.	TACRI	Kilimanjaro	Questionnaires
16.	Tanzania Tree Seeds Agency (TTSA)	Morogoro	Visit & Questionnaires
17.	Tanzania Fisheries Research Institute (TAFIRI)	Dare Es Salaam & Kigoma)	Visit & Quesrionnaires
18.	WWF	Dar es Salaam	Visit
19.	Kilimanjaro Region Head Office (Regional Administrative Secretary Office)	Moshi	Visit
20.	Saadani National Park	Tanga/Pwani	Visit
21.	TANROADS MOSHI	Kilimanjaro	Visit
22.	TAFORI	Moshi	Visit
23.	Pangani Basin Water Boardy - Moshi	Moshi	Visit
24.	Meru District Council (Ngarenanyuki)	Meru	Visit
25.	Tanzania Fisheries Research Institute (TAFIRI)	Dar es Salaam, Headquarters	Visit
26.	UNEP (Country Office)	Dar es Salaam	Visit
27.	UNDP (Country Office)	Dar es Salaam	Visit
28.	Dr. Benjamin Ngatunga (Ret. TAFIRI CEO)	Dar es Salaam	Interview
29.	Wildlife Conservation Society Tanzania	Kitulo NP	Questionnaires
30.	Chome Nature Reserve	Same	Questionnaires
31.	Tanzania Forest Service	Dar es Salaam	Questionnaires
32.	Tanzania Natural Resource Forum	Arusha	Visit
33.	MVIWATA	Morogoro	Visit
34.	AWF	Dar es Salaam	Visit
35.	UNDP	Dar es Salaam	Visit
36.	ICRAF	Dar es Salaam	Visit
37.	IUCN	Dar es Salaam	Visit
38.	Sopa Lodges	Arusha	Visit
39.	Serena Hotels	Arusha	Visit
40.	Tanzania Wildlife Research Institute	Arusha	Questionnaires
41.	Tanzania Forestry Research Institute	Morogoro	Questionnaires

S/No.	List of stakeholders	Location	Mode of information gathering
42.	Tanzania Fisheries Research Institute	Mwanza	Questionnaires
43.	National Environment Management Council	Dar es Salaam	Questionnaires
44.	Sokoine University of Agriculture	Morogoro	Visit
45.	Institute of Resource Assessment	Dar es Salaam	Questionnaires
46.	University of Dar es Salaam	Dar es Salaam	Questionnaires
47.	Tanzania Tree Seed Agency	Morogoro	Questionnaires
48.	University of Dodoma	Dodoma	Questionnaires
49.	Fisheries Education and Training Agency	Mwanza	Visit
50.	Nelson Mandela University of Science and Technology	Arusha	Questionnaires
51.	Livestock Multiplication Unit	Mabuki (Mwanza)	Visit
52.	TARI	Ukirigulu (Mwanza)	Visit
53.	Missenyi District Council	Kagera	Visit
54.	Burigi, Biharamulo and Kimisi National Parks	Lake Zone	Visit

Appendix 6: Dodoso Kuhusu Viumbe Vamizi/Wageni kwa Kushirikisha Wadau na Viongozi wa Taasisi Mbalimbali Nchini

Viumbe Viumbe wageni/vamizi: *Viumbe ambao sio wa asili katika eneo husika ambaokuwapo kwake kunaleta madhara katika mazingira, huduma, afya na uchumi.*

1. Jina la Mdau au Kundi.....
2. Nafasi yako / Mahali ulipo.....
3. Je unajua nini maana ya viumbe vamizi?
4. Ninyi mmejijhusisha/mnajihusisha zaidi na viumbe gani
vamizi?.....
5. Je, viumbe vamizi muwajua ni wa asili ama wageni katika eneo
husika?.....
6. Unadhani ni njia gani zilizopelekea kuingia kwa viumbe hao? Ama nini chanzo cha viumbe hao kuwa
vamizi katika eneo husika?.....
7. Je unaona ni sekta ipi imeathiriwa zaidi na viumbe vamizi na ni kwanini
unaonahivyo?.....
8. Shughuli /Miradi gani inayofanyika au inayoendelea kufanyika kuhusiana na viumbe wageni na
vamizi?
9. Tafadhali orodhesha na kututumia takwimu/ taarifa au machapisho yoyote mliyonyo kuhusiana na
viumbe wageni na vamizi katika sekta yenu
10. Je, mmeona madhara gani ya uwepo wa viumbe wageni na vamizi katika sekta yenu na nchi kwa
ujumla?.....
11. Je mmeona faida gani ya uwepo wa viumbe wageni na vamizi katika sekta yenu na nchi kwa ujumla?
.....
12. Eleza njia gani zinatumiwa/zimetumiwa kudhibiti viumbe hivyo vamizi na ufanisi wake?
13. Je, kuna mbinu zozote za asili zinazotumiwa kukabiliana na viumbe vamizi/
wageni?.....
14. Pamoja na mbinu zinazotumiwa/tajwa hapo juu, je, nini mapendekezo yako/yenu juu ya mbinu
nyingine?.....
15. Je, mnapataje taarifa au mnaperekaje taarifa za viumbe wageni na vamizi kwa taasisi nyingine
mnazoshirikiana nazo?.....
16. Eleza aina ya ushirikiano mlio nao baina yenu na wadau wengine katika kukabiliana na viumbe
wageni/vamizi.....
17. Nini maoni yako au yenu juu ya madhara pindi viumbe wageni/vamizi watakapoondolewa au
kudhibitiwa?.....
18. Eleza endapo una/mna mpango kazi wowote wa namna ya kutatua changamoto za viumbe wageni na
vamizi katika maeneo yenu/sekta yenu.....
19. Je kuna mapendekezo yoyote ya kisheria kuhusiana na utatuzi wa changamoto za viumbe wageni na
vamizi?.....
20. Eleza ushirikishwaji wa jamii katika maeneo yako/yenu katika kuelimisha jinsi ya kukabiliana na
viumbe wageni na vamizi.....
21. Nini maoni au ushauri wako/wenu kuhusu hatua za kuchukua katika kudhibiti viumbe wageni/vamizi
katika maeneo yenu?.....

----- Nakushuru sana kwa muda wako -----

Appendix 7: List of Participants in the Consultative Workshop conducted between 8th and 9th January 2019 in Morogoro

SN.	NAME	SECTOR MINISTRIES/INSTITUTION	REGION
	Mr. Rogasian Lukoa	PO- RALG	Dodoma
	Ms. Imelda Ukugani	Vice president's office; DoE	Dodoma
	Mr.Timotheo Mande	Vice president's office; DoE	Dodoma
	Mr.Said Maurussu	Ministry of works, transport and communication (transport sector)	Dodoma
	Eng. Chacha Haroun	Ministry of works, transport and communication (works)	Dodoma
	Ms.Blandina Mkayula	Ministry of science, education and higher learning institution	Dodoma
	Ms.Anna Sekiete	Ministry of health, gender, community development, elderly and children	Dodoma
	Ms.Beatrice Pallangyo	Ministry of agriculture	Dodoma
	Dr. Mary Kishe	Ministry of livestock and fisheries development (fisheries),	Dodoma
	Mr.Deogratias Gambago	Ministry of livestock and fisheries development (livestock)	Dodoma
	Ms. Praxedas Paul	Ministry of Water	Dodoma
	Mr. Ansbert Rwamahe	Ministry of natural resources and tourism (wildlife)	Dodoma
	Ms.Flora Akwilapo	NEMC	DSM
	Dr. Abel Masota	TFS	DSM
	Mr. Harun Makandi	COSTECH	DSM
	Dr. Emma Liwenga	UDSM – IRA	DSM
	Mr. Godwell Meing'ataki	TANAPA	Arusha
	Dr. Anthony Sengeda	SUA	Morogoro
	Ms. Beatrice Benjamin	Mweka Wildlife College	Kilimanjaro
	Dr. Wilfred Marealle	TAWIRI	Arusha
	Mr.Hillary Mushi	NCA	Arusha
	Mr.Fandey Mashimba	TTSA	Morogoro
	Dr. Ephrem Njau	TPRI	Arusha
	Dr. Siima Bakengesa	TAFORI	Morogoro
	Dr. Francis Moyo	Nelson Mandela African Institute of Science and Technology- NM-AIST	Arusha
	Dr. Ismael Kimerei	TAFIRI	DSM
	Mr.Charles Bonaventure	ECHO	Arusha
	Mr. Erick Joseph	TAHA	Arusha
	Mr. Ndelekwa Kaaya	GUGU KAROTI	Arusha
	Dr. Zabron Nziku	TALIRI	Dodoma
	Ms.Zena Mwankemwa	TOSCI HQ	Morogoro
	Dr. Benjamin Ngatunga	Private sector	DSM
	Dr. Evarist Makene	TARI	Dodoma
	Mr.Aloyce Mpinge	TAWA	Morogoro

Appendix 8: List of invasive and potential invasive species of Tanzania

Organism	Origin		Total
	Alien	Native	
Animalia	36	3	39
Bird	1	1	2
<i>Corvus splendens</i>	X		x
<i>Quelea quelea</i>		x	x
Fish	22	2	24
<i>Acanthaster planci</i>	X		x
<i>Anguilla anguilla</i>	X		x
<i>Anguilla bengalensis bengalensis</i>	X		x
<i>Clarias gariepinus</i>		x	x
<i>Coptodon rendalli</i>		x	x
<i>Coptodon zillii</i>	X		x
<i>Crassostrea gigas</i>	X		x
<i>Ctenopharyngodon idella</i>	X		x
<i>Cyprinus carpio</i>	X		x
<i>Lates niloticus</i>	X		x
<i>Leiostomus xanthurus</i>	X		x
<i>Lutjanus kasmira</i>	X		x
<i>Macrobranchium idella</i>	X		x
<i>Macrobranchium rosenbergii</i>	X		x
<i>Micropterus salmoides</i>	X		x
<i>Mnemiopsis leidyi</i>	X		x
<i>Musculista senhousia</i>	X		x
<i>Oncorhynchus mykiss</i>	X		x
<i>Oreochromis leucostictus</i>	X		x
<i>Oreochromis niloticus</i>	X		x
<i>Phallocceros caudimaculatus</i>	X		x
<i>Poecilia reticulata</i>	X		x
<i>Procambarus clarkia</i>	X		x
<i>Salmo trutta</i>	X		x
Insect	12	1	13
<i>Alcaeus varicornis</i>	X		x
<i>Bactrocera dorsalis</i>	X		x
<i>Chrysomya bezziana</i>		x	x
<i>Cinara cupressi sensu lato</i>	X		x
<i>Culex quinquefasciatus</i>	X		x
<i>Icerya purchasi</i>	X		x
<i>Leptocybe invasa</i>	X		x
<i>Paranaleptes reticulata</i>	X		x
<i>Phenacoccus manihoti</i>	X		x
<i>Pineus pini</i>	X		x
<i>Spodoptera frugiperda</i>	X		x
<i>Thaumastocoris peregrinus</i>	X		x
<i>Tuta absoluta</i>	X		x
Mammal	1		1

Organism	Origin		Total
	Alien	Native	
<i>Rattus rattus</i>	X		x
Fungi	2		2
Fungi	2		2
<i>Fusarium oxysporum</i> f.sp. cubense	X		x
<i>Mycosphaerella fijiensis</i>	X		x
Plantae	164	15	179
Cactus	4		4
<i>Austrocylindropuntia subulata</i>	X		x
<i>Opuntia humifusa</i> var. <i>humifusa</i>	X		x
<i>Opuntia monacantha</i>	X		x
<i>Opuntia vulgaris</i>	X		x
Climber	5	1	6
<i>Cardiospermum grandiflorum</i>	X		x
<i>Cardiospermum halicacabum</i>	X		x
<i>Dolichandra unguis-cati</i>	X		x
<i>Landolphia owariensis</i>		x	x
<i>Mimosa diplotricha</i>	X		x
<i>Pyrostegia venusta</i>	X		x
Fern	3		3
<i>Azolla filiculoides</i>	X		x
<i>Azolla pinnata</i> subsp. <i>africana</i>	X		x
<i>Selaginella biformis</i>	X		x
Grass	9	5	14
<i>Arundo donax</i>	X		x
<i>Chimonobambusa quadrangularis</i>	X		x
<i>Digitaria leucites</i>		x	x
<i>Eleusine jaegeri</i>		x	x
<i>Imperata cylindrica</i>		x	x
<i>Paspalum vaginatum</i>	X		x
<i>Pennisetum clandestinum</i>		x	x
<i>Pennisetum pedicellatum</i>		x	x
<i>Phyllostachys bambusoides</i>	X		x
<i>Phyllostachys nigra</i>	X		x
<i>Phyllostachys reticulata</i>	X		x
<i>Saccharum officinarum</i>	X		x
<i>Sacciolepis indica</i>	X		x
<i>Schizostachyum dullooa</i>	X		x
Herb	54	7	61
<i>Agave americana</i>	X		x
<i>Agave angustifolia</i>	X		x
<i>Agave sisalana</i>	X		x
<i>Ageratum conyzoides</i>	X		x
<i>Ageratum houstonianum</i>	X		x
<i>Alternanthera pungens</i>	X		x
<i>Amaranthus hybridus</i>	X		x
<i>Argemone mexicana</i>	X		x

Organism	Origin		Total
	Alien	Native	
<i>Argemone ochroleuca</i>	X		x
<i>Astripomoea hyoscyamoides</i>	X		x
<i>Bidens kilimandscharica</i>	X		x
<i>Bidens pilosa</i>	X		x
<i>Bidens schimperii</i>		x	x
<i>Calotropis procera</i>		x	x
<i>Capsella bursa-pastoris</i>	X		x
<i>Catharanthus roseus</i>	X		x
<i>Cedrella odorata</i>	X		x
<i>Chromolaena odorata</i>	X		x
<i>Cinchona pubescens</i>	X		x
<i>Conyza floribunda</i>	X		x
<i>Cordia alliodora</i>	X		x
<i>Cosmos sulphureus</i>	X		x
<i>Cyperus rotundus</i>	X		x
<i>Datura erecta</i>	X		x
<i>Datura ferox</i>	X		x
<i>Datura metel</i>	X		x
<i>Datura stramonium</i>	X		x
<i>Eclipta alba</i>	X		x
<i>Epipremnum pinnatum</i>	X		x
<i>Erigeron karvinskianus</i>	X		x
<i>Erigeron sumatrensis</i>	X		x
<i>Fimbristylis littoralis</i>	X		x
<i>Gomphrena celosioides</i>	X		x
<i>Gutenbergia cordifolia</i>		x	x
<i>Ipomoea cairica</i>		x	x
<i>Ipomoea hildebrandtii</i>		x	x
<i>Kalanchoe delagoensis</i>	X		x
<i>Manihot carthaginensis</i>	X		x
<i>Manihot esculenta</i>	X		x
<i>Medicago laciniata</i>	X		x
<i>Monstera deliciosa</i>	X		x
<i>Murdannia nudiflora</i>	X		x
<i>Musa paradisiaca</i>	X		x
<i>Nasturtium officinale</i>	X		x
<i>Parthenium hysterophorus</i>	X		x
<i>Phylla nodiflora</i>	X		x
<i>Polygala paniculata</i>	X		x
<i>Sonchus asper</i>	X		x
<i>Stachytarpheta jamaicensis</i>	X		x
<i>Stachytarpheta urticifolia</i>	X		x
<i>Striga asiatica</i>		x	x
<i>Striga hermonthica</i>		x	x
<i>Tagetes minuta</i>	X		x
<i>Thunbergia grandiflora</i>	X		x

Organism	Origin		Total
	Alien	Native	
<i>Tithonia diversifolia</i>	X		x
<i>Trapa natans</i>	X		x
<i>Tridax procumbens</i>	X		x
<i>Verbena bonariensis</i>	X		x
<i>Verbena officinalis</i>	X		x
<i>Xanthium strumarium</i>	X		x
<i>Xanthosoma sagittifolium</i>	X		x
Palm	4		4
<i>Aiphanes horrida</i>	X		x
<i>Areca catechu</i>	X		x
<i>Arenga pinnata</i>	X		x
<i>Elaeis guineensis</i>	X		x
Shrub	22	1	23
<i>Acacia mearnsii</i>	X		x
<i>Acer oblongum</i>	X		x
<i>Caesalpinia decapetala</i>	X		x
<i>Calotropis gigantea</i>	X		x
<i>Camellia sinensis</i>	X		x
<i>Cascabela thevetia</i>	X		x
<i>Cascabela thevetia</i>	X		x
<i>Cassia occidentalis</i>	X		x
<i>Cinnamomum camphora</i>	X		x
<i>Cinnamomum verum</i>	X		x
<i>Clidemia hirta</i>	X		x
<i>Jatropha curcas</i>	X		x
<i>Lantana camara</i>	X		x
<i>Lantana montevidensis</i>	X		x
<i>Mimosa pigra</i>	X		x
<i>Mimosa pudica</i>	X		x
<i>Nicotiana glauca</i>	X		x
<i>Psidium guajava</i>	X		x
<i>Ricinus communis</i>	X		x
<i>Rubus niveus</i>	X		x
<i>Rubus rosifolius</i>	X		x
<i>Senna multijuga</i>	X		x
<i>Solanum incanum</i>		x	x
Tree	56	1	57
<i>Acacia insulae-iacobi</i>	X		x
<i>Acacia mangium</i>	X		x
<i>Acacia melanoxylon</i>	X		x
<i>Acacia zanzibarica</i>	X		x
<i>Acrocarpus frainifolius</i>	X		x
<i>Albizia chinensis</i>	X		x
<i>Anacardium occidentale</i>	X		x
<i>Annona cherimola</i>	X		x
<i>Annona senegalensis</i>	X		x

Organism	Origin		Total
	Alien	Native	
<i>Artocarpus heterophyllus</i>	X		x
<i>Azadirachta indica</i>	X		x
<i>Bambusa bambos</i>	X		x
<i>Brugmansia suaveolens</i>	X		x
<i>Castilla elastica</i>	X		x
<i>Casuarina equisetifolia</i>	X		x
<i>Citrus aurantium</i>	X		x
<i>Citrus limon</i>	X		x
<i>Cupressus lusitanica</i>	X		x
<i>Dalbergia sissoo</i>	X		x
<i>Eriobotrya japonica</i>	X		x
<i>Eucalyptus citriodora</i>	X		x
<i>Eucalyptus globulus</i> subsp. <i>bicostata</i>	X		x
<i>Eucalyptus maidenii</i> subsp. <i>globulus</i>	X		x
<i>Eucalyptus panicula</i>	X		x
<i>Eucalyptus saligna</i>	X		x
<i>Euphorbia tirucalli</i>	X		x
<i>Grevillea robusta</i>	X		x
<i>Hevea brasiliensis</i>	X		x
<i>Hovenia dulcis</i>	X		x
<i>Hura crepitans</i>	X		x
<i>Jacaranda mimosifolia</i>	X		x
<i>Lagerstroemia speciosa</i>	X		x
<i>Leucaena leucocephala</i>	X		x
<i>Maesopsis eminii</i>	X		x
<i>Mangifera indica</i>	X		x
<i>Melaleuca quinquenervia</i>	X		x
<i>Melia azedarach</i>	X		x
<i>Muntingia calabura</i>	X		x
<i>Pinus caribaea</i>	X		x
<i>Pinus patula</i>	X		x
<i>Pinus radiata</i>	X		x
<i>Piper hispidum</i>	X		x
<i>Prosopis juliflora</i>	X		x
<i>Psidium cattleianum</i>	X		x
<i>Psidium guineense</i>	X		x
<i>Schinus molle</i>	X		x
<i>Schizolobium parahyba</i>	X		x
<i>Senna siamea</i>	X		x
<i>Senna spectabilis</i>	X		x
<i>Spathodea campanulata</i>		x	x
<i>Spondias mombin</i>	X		x
<i>Syzygium aromaticum</i>	X		x
<i>Syzygium jambos</i>	X		x
<i>Syzygium malaccense</i>	X		x
<i>Tectona grandis</i>	X		x

Organism	Origin		Total
	Alien	Native	
<i>Theobroma cacao</i>	X		x
<i>Toona ciliata</i>	X		x
Aquatic	2		2
<i>Eichhornia crassipes</i>	X		x
<i>Pistia stratiotes</i>	X		x
Algae	4		4
<i>Amphidinium carterae</i>	X		x
<i>Gambierdiscus toxicus</i>	X		x
<i>Kappaphycus</i> spp	X		x
<i>Protocentrum arenarium</i>	X		x
Grand Total	202	18	220

Appendix 9: List of species that are known to be invasive in Tanzania

S/N	Scientific name	Common name	Local Name	Life form	Organism	Alien/ Native
1	<i>Acacia insulae-iacobi</i>	Acacia, algarrobo	Mkesia	Tree	Plantae	Alien
2	<i>Acacia mangium</i>	Forest mangrove	Mkesia	Tree	Plantae	Alien
3	<i>Acacia mearnsii</i>	Black wattle	Mwati, Mbalikiwato	Tree	Plantae	Alien
4	<i>Acacia melanoxylon</i>	Blackwood	Mtasimana, Mkababu	Tree	Plantae	Alien
5	<i>Acacia zanzibarica</i>	Coastal whistling thorn	Mpiga mururu	Tree	Plantae	Native
6	<i>Areca catechu</i>	Areca palm	Mpopoa	Palm	Plantae	Alien
7	<i>Arenga pinnata</i>	Black sugar palm	Ale, Maale	Palm	Plantae	Alien
8	<i>Argemone mexicana</i>	Mexican poppy		Herb	Plantae	Alien
9	<i>Argemone ochroleuca</i>	Mexican poppy		Herb	Plantae	Alien
10	<i>Atripomoea hyoscyamoides</i>	Kongwa weed	Mahata	Herb	Plantae	Native
11	<i>Azolla filiculoides</i>	Water fern		Fern	Plantae	Alien
12	<i>Azolla pinnata subsp. africana</i>	Mosquito fern		Fern	Plantae	Alien
13	<i>Bactrocera dorsalis</i>	Oriental fruit fly	Nzi wa matunda	Insect	Animalia	Alien
14	<i>Bambusa bambos</i>	Giant Thorny Bamboo	Mwanzi	Bamboo	Plantae	Alien
15	<i>Bidens pilosa</i>	Blackjark	Shona nguo	Herb	Plantae	Alien
16	<i>Bidens schimperi</i>	Beggarticks		Herb	Plantae	Native
17	<i>Caesalpinia decapetala</i>	Mysore Thorn	Lutona, Olmashinga	Shrub	Plantae	Alien
18	<i>Calotropis gigantea</i>	Giant Milkweed	Mbofubofu, Mbombom	Shrub	Plantae	Alien
19	<i>Calotropis procera</i>	Rubber bush	Bofubofu, bomubomu	Shrub	Plantae	Native
20	<i>Castilla elastica</i>	Panama rubber tree	Mpia. Mpira	Tree	Plantae	Alien
21	<i>Casuarina equisetifolia</i>	Casuarina	Mvinje	Tree	Plantae	Alien
22	<i>Cedrella odorata</i>	Cedar Wood	Msederea	Tree	Plantae	Alien
23	<i>Chromolaena odorata</i>	Siam weed	Amachabongo	Shrub	Plantae	Alien
24	<i>Cinara cupressi</i>	Cypress aphid		Insect	Animalia	Alien
25	<i>Clidemia hirta</i>	Koster's curse kui	Uharage	Shrub	Plantae	Alien
26	<i>Coptodon rendalli</i>	redbreast tilapia		Fish	Animalia	Alien
27	<i>Coptodon zillii</i>	Redbelly tilapia		Fish	Animalia	Alien
28	<i>Cordia alliodora</i>	salmwood	Munyamasa	Tree	Plantae	Alien
29	<i>Corvus splendens</i>	Indian house crow	Kunguru wa Zanzibar	Bird	Animalia	Alien
30	<i>Culex quinquefasciatus</i>	southern house mosquito	Mbu	Insect	Animalia	Alien
31	<i>Datura erecta</i>	Thorn Apple		Herb	Plantae	Alien
32	<i>Datura ferox</i>	Long spined thorn apple		Herb	Plantae	Alien
33	<i>Datura metel</i>	Thorn Apple		Herb	Plantae	Alien
34	<i>Datura stramonium</i>	Devil's snare	Msiafu	Herb	Plantae	Alien

S/N	Scientific name	Common name	Local Name	Life form	Organism	Alien/ Native
35	<i>Eichhornia crassipes</i>	Water hyacinth	Gugu maji	Aquatic plant	Plantae	Alien
36	<i>Elaeis guineensis</i>	African oil palm	Muwese	Palm	Plantae	Alien
37	<i>Eleusine jaegeri</i>	Goosegrass	Makutian	Grass	Plantae	Alien
38	<i>Eucalyptus citriodora</i>	Lemon Scented Eucalyptus	Mkaratusi	Tree	Plantae	Alien
39	<i>Eucalyptus globulus</i>	Southern blue-gum	Mkaratusi	Tree	Plantae	Alien
40	<i>Eucalyptus panicula</i>	Grey ironbark	Mkaratusi	Tree	Plantae	Alien
41	<i>Fusarium oxysporum</i>	Fusarium wilt of tomato		Fungi	Fungi	Alien
42	<i>Gutenbergia cordifolia</i>	Gutenbergia		Herb	Plantae	Native
43	<i>Imperata cylindrica</i>	Cogon grass		Grass	Plantae	Alien
44	<i>Ipomoea hildebrandtii</i>			Herb	Plantae	Native
45	<i>Landolphia owariensis</i>	White rubber vine		Climber	Plantae	Native
46	<i>Lantana camara</i>	West Indian Lantana	Mvuti	Shrub	Plantae	Alien
47	<i>Lates niloticus</i>	Nile perch	Sangara	Fish	Animalia	Alien
48	<i>Leptocybe invasa</i>	Eucalyptus gall wasp		Insect	Animalia	Alien
49	<i>Leucaena leucocephala</i>	River tamarind	Lukina, Mkusina	Tree	Plantae	Alien
50	<i>Maesopsis eminii</i>	Umbrella tree	Mlesi, Muhumula, Musira	Tree	Plantae	Alien
51	<i>Micropterus salmoides</i>	Largemouth bass		Fish	Animalia	Alien
52	<i>Mimosa diplotricha</i>	Giant sensitive plant,		Climber	Plantae	Alien
53	<i>Mimosa pigra</i>	Black mimosa		Shrub	Plantae	Alien
54	<i>Opuntia humifusa</i>	Devil's-tongue	Dungusi	Cactus	Plantae	Alien
55	<i>Opuntia monacantha</i>	Common prickly pear	Dungusi	Cactus	Plantae	Alien
56	<i>Oreochromis leucostictus</i>	Blue-spotted tilapia		Fish	Animalia	Alien
57	<i>Oreochromis niloticus</i>	Tilapia		Fish	Animalia	Alien
58	<i>Paranaleptes reticulata</i>	Tree girdling beetle		Insect	Animalia	Alien
59	<i>Parthenium hysterophorus</i>	Carrot weed	Gugu karoti	Herb	Plantae	Alien
60	<i>Phyllostachys bambusoides</i>	small bamboo,		Grass	Plantae	Alien
61	<i>Pistia stratiotes</i>	Water cabbage		Aquatic plant	Plantae	Alien
62	<i>Prosopis juliflora</i>	Velvet mesquite	Mrashia, Mgunga Taveta	Tree	Plantae	Alien
63	<i>Psidium cattleianum</i>	Strawberry guava	Mpera, mpera-ng'ombe	Tree	Plantae	Alien
64	<i>Rattus rattus</i>	The black rat	Panya	Mammal	Animalia	Alien

S/N	Scientific name	Common name	Local Name	Life form	Organism	Alien/ Native
65	<i>Rubus rosifolius</i>	Mauritius raspberry	Mwiba, Mchaa, Subirikidogo	Shrub	Plantae	Alien
66	<i>Senna spectabilis</i>	Popcorn Tree	Mjoholo-lua	Tree	Plantae	Alien
67	<i>Solanum incanum</i>	Bitter apple, sodom apple	Ndulele, Mtula	Shrub	Plantae	Native
68	<i>Spodoptera frugiperda</i>	Fall armyworm	Kiwavijeshi vamizi	Insect	Animalia	Alien
69	<i>Striga asiatica</i>	Asiatic witchweed	Kiduha	Herb	Plantae	Native
70	<i>striga hermonthica</i>	Witchweed	Kiduha	Herb	Plantae	Native
71	<i>Tagetes minuta</i>	Marigold	Mkomahola	Herb	Plantae	Alien
72	<i>Tithonia diversifolia</i>	Tree marigold		Herb	Plantae	Alien
73	<i>Trapa natans</i>	Waterchestnut		Aquatic plant	Plantae	Alien
74	<i>Tuta absoluta</i>	Tomato leaf miner	Kanitangaze	Insect	Animalia	Alien
75	<i>Xanthium strumarium</i>	Rough cocklebur		Herb	Plantae	Alien

Appendix 10: List of species that are potentially invasive in Tanzania

S/N	Scientific name	Common name	Local Name	Life form	Organism	Alien/ Native
1	<i>Acer oblongum</i>	Himalayan maple		Shrub	Plantae	Alien
2	<i>Acrocarpus frainifolius</i>	Pink cedar	Mtikivuli	Tree	Plantae	Alien
3	<i>Agave americana</i>	American aloe	Katani, mkonge	Herb	Plantae	Alien
4	<i>Agave angustifolia</i>	Caribbean agave		Herb	Plantae	Alien
5	<i>Agave sisalana</i>	Sisal plant	Katani, mkonge	Herb	Plantae	Alien
6	<i>Ageratum conyzoides</i>	Goatweed	Bukabuka,	Herb	Plantae	Alien
7	<i>Ageratum houstonianum</i>	Blueweed	Beenge,	Herb	Plantae	Alien
8	<i>Aiphanes horrida</i>	Coyupe Palm		Palm	Plantae	Alien
9	<i>Albizia chinensis</i>	Chinese albizia	Mshai	Tree	Plantae	Alien
10	<i>Alcaeus varicornis</i>	Acacia shield bug		Insect	Animalia	Alien
11	<i>Alternanthera pungens</i>	Creeping chaffweed		Herb	Plantae	Alien
12	<i>Amaranthus hybridus</i>	Green amaranth	Mchicha pori	Herb	Plantae	Alien
13	<i>Amphidinium carterae</i>			Algae	Plantae	Alien
14	<i>Anacardium occidentale</i>	Cashew tree	Mkorosho	Tree	Plantae	Alien
15	<i>Anguilla anguilla</i>	European eel		Fish	Animalia	Alien
16	<i>Anguilla bengalensis</i>	African mottled eel		Fish	Animalia	Alien
17	<i>Annona cherimola</i>	Cherimoya	Mtopetope	Tree	Plantae	Alien
18	<i>Annona senegalensis</i>	African custard-apple	Motope- tope, Nkonola	Tree	Plantae	Alien
19	<i>Areca catechu</i>	Areca palm		Palm	Plantae	Alien
20	<i>Artocarpus heterophyllus</i>	Jackfruit	Mfenesi	Tree	Plantae	Alien
21	<i>Arundo donax</i>	Giant cane		Grass	Plantae	Alien
22	<i>Austrocylindropuntia subulata</i>	Devil's rope		Cactus	Plantae	Alien
23	<i>Azadirachta indica</i>	Nimtre, Indian lilac	Mwarobaini	Tree	Plantae	Alien
24	<i>Bidens kilimandscharica</i>			Herb	Plantae	Alien
25	<i>Brugmansia suaveolens</i>	Moon flower		Tree	Plantae	Alien
26	<i>Camellia sinensis</i>	Tea plant	Chai	Shrub	Plantae	Alien
27	<i>Capsella bursa-pastoris</i>	Coffee senna		Herb	Plantae	Alien
28	<i>Cardiospermum grandiflorum</i>	Balloon vine	Burili	Climber	Plantae	Alien
29	<i>Cardiospermum halicacabum</i>	Balloon plant		Climber	Plantae	Alien
30	<i>Cascabela thevetia</i>	Old World screwworm fly		Shrub	Plantae	Alien
31	<i>Cascabela thevetia</i>	Yellow oleander		Shrub	Plantae	Alien
32	<i>Cassia occidentalis</i>	Coffee senna		Shrub	Plantae	Alien

S/N	Scientific name	Common name	Local Name	Life form	Organism	Alien/ Native
33	<i>Catharanthus roseus</i>	Madagascar periwinkle	Vinka	Herb	Plantae	Alien
34	<i>Chimonobambusa quadrangularis</i>	Bamboo	Mwanzi	Grass	Plantae	Alien
35	<i>Chrysomya bezziana</i>	Screwworm		Insect	Animalia	Native
36	<i>Cinchona pubescens</i>	Cinchona tree		Herb	Plantae	Alien
37	<i>Cinnamomum camphora</i>	Camphor tree	Mkarafuu maiti	Shrub	Plantae	Alien
38	<i>Cinnamomum verum</i>	cinnamon	Mdalasini	Shrub	Plantae	Alien
39	<i>Citrus aurantium</i>	Sour orange		Tree	Plantae	Alien
40	<i>Citrus limon</i>	Bitter Orange	Mlimao	Tree	Plantae	Alien
41	<i>Clarias gariepinus</i>	African sharptooth catfish	Mumi	Fish	Animalia	Native
42	<i>Conyza floribunda</i>	Horseweed		Herb	Plantae	Alien
43	<i>Cosmos sulphureus</i>	Yellow cosmos		Herb	Plantae	Alien
44	<i>Crassostrea gigas</i>	Pacific oyster		Mollusca	Animalia	Alien
45	<i>Ctenopharyngodon idella</i>	Grass carp		Fish	Animalia	Alien
46	<i>Cupressus lusitanica</i>	White cedar	Msanduku, Mkrismasi	Tree	Plantae	Alien
47	<i>Cyperus rotundus</i>	Nut sedge		Herb	Plantae	Alien
48	<i>Cyprinus carpio</i>	Common carp		Fish	Animalia	Alien
49	<i>Dalbergia sissoo</i>	Indian rosewood		Tree	Plantae	Alien
50	<i>Digitaria leucites</i>	Crabgrass		Grass	Plantae	Native
51	<i>Dolichandra unguis-cati</i>	Claw creeper		Climber	Plantae	Alien
52	<i>Eclipta alba</i>	Bhringraj		Herb	Plantae	Alien
53	<i>Epipremnum pinnatum</i>	Dragon-tail plant		Herb	Plantae	Alien
54	<i>Erigeron karvinskianus</i>	Mexican fleabane		Herb	Plantae	Alien
55	<i>Erigeron sumatrensis</i>	Tall Fleabane learn		Herb	Plantae	Alien
56	<i>Eriobotrya japonica</i>	Loquat	Msambia, Kipirha	Tree	Plantae	Alien
57	<i>Eucalyptus maidenii subsp. Globulus</i>	Southern blue-gum	Mkaratusi	Tree	Plantae	Alien
58	<i>Eucalyptus saligna</i>	Sydney blue gum	Mkaratusi	Tree	Plantae	Alien
59	<i>Euphobia tirucalii</i>	Pencil cactus	Ganga, Mlangara	Tree	Plantae	Alien
60	<i>Fimbristylis littoralis</i>	Lesser fimbry		Herb	Plantae	Alien
61	<i>Gambierdiscus toicus</i>			Algae	Plantae	Alien
62	<i>Gomphrena celosioides</i>	Bachelor's Button		Herb	Plantae	Alien
63	<i>Grevilea robusta</i>	Silk oak	Mwerezi, mgrevilea	Tree	Plantae	Alien
64	<i>Hevea brasiliensis</i>	Rubber tree	Mpia	Tree	Plantae	Alien
65	<i>Hovenia dulcis</i>	Oriental raisin tree		Tree	Plantae	Alien

S/N	Scientific name	Common name	Local Name	Life form	Organism	Alien/ Native
66	<i>Hura crepitans</i>	Sandbox tree	Mbaika	Tree	Plantae	Alien
67	<i>Icerya purchasi</i>	Cottony cushion scale		Insect	Animalia	Alien
68	<i>Ipomoea cairica</i>	Morning glory		Herb	Plantae	Native
69	<i>Jacaranda mimosifolia</i>	Blue jacaranda	Mjakaranda	Tree	Plantae	Alien
70	<i>Jatropha curcas</i>	Physic nut		Shrub	Plantae	Alien
71	<i>Kalanchoe delagoensis</i>	Chandelier Plant		Herb	Plantae	Alien
72	<i>Kappaphycus spp</i>	elkhorn sea moss		Algae	Plantae	Alien
73	<i>Lagerstroemia speciosa</i>	Giant crepe-myrtle		Tree	Plantae	Alien
74	<i>Lantana montevidensis</i>	Trailing Lantana		Shrub	Plantae	Alien
75	<i>Leiostomus xanthurus</i>	Spot, Norfolk spot		Fish	Animalia	Alien
76	<i>Lutjanus kasmira</i>	Bluestripe Snapper		Fish	Animalia	Alien
77	<i>Macrobrachium idella</i>	Monsoon river prawn		Fish	Animalia	Alien
78	<i>Macrobrachium rosenbergii</i>	Giant freshwater prawn		Fish	Animalia	Alien
79	<i>Mangifera indica</i>	Mango	Mwembe	Tree	Plantae	Alien
80	<i>Manihot carthaginensis</i>	Ceara Rubber Tree		Herb	Plantae	Alien
81	<i>Manihot esculenta</i>	Bitter cassava	Mhogo	Herb	Plantae	Alien
82	<i>Medicago laciniata</i>	Cutleaf medick		Herb	Plantae	Alien
83	<i>Melaleuca quinquenervia</i>	Broad-leaved paperbark		Tree	Plantae	Alien
84	<i>Melia azedarach</i>	Chinaberry tree	Mpopote, Mmelia	Tree	Plantae	Alien
85	<i>Mimosa pudica</i>	Touch-me-not	Kifachauongo	Shrub	Plantae	Alien
86	<i>Mnemiopsis leidyi</i>	Sea walnut		Fish	Animalia	Alien
87	<i>Monstera deliciosa</i>	Split-leaf philodendron		Herb	Plantae	Alien
88	<i>Murdannia nudiflora</i>	Doveweed		Herb	Plantae	Alien
89	<i>Mutingia calabura</i>	Jamaica cherry		Tree	Plantae	Alien
90	<i>Musa paradisiaca</i>	Madake	Mgomba	Herb	Plantae	Alien
91	<i>Musculista senhousia</i>	Pine woolly aphid	Konokono	Mollusca	Animalia	Alien
92	<i>Mycosphaerella fijiensis</i>	Black leaf streak		Fungi	Fungi	Alien
93	<i>Nasturtium officinale</i>	Yellow cress		Herb	Plantae	Alien
94	<i>Nicotiana glauca</i>	Tree tobacco		Shrub	Plantae	Alien
95	<i>Oncorhynchus mykiss</i>	Granman-ana-oudou		Fish	Animalia	Alien
96	<i>Opuntia vulgaris</i>	Prickly pear		Herb	Plantae	Alien
97	<i>Paspalum vaginatum</i>	Biscuit grass		Grass	Plantae	Alien
98	<i>Pennisetum clandestinum</i>	Kikuyu grass		Grass	Plantae	Native
99	<i>Pennisetum pedicellatum</i>	Desho grass		Grass	Plantae	Native

S/N	Scientific name	Common name	Local Name	Life form	Organism	Alien/ Native
100	<i>Phalloceros caudimaculatus</i>	One-spot livebearer		Fish	Animalia	Alien
101	<i>Phenacoccus manihoti</i>	Cassava mealybug		Insect	Animalia	Alien
102	<i>Phyla nodiflora</i>	Frog fruit		Herb	Plantae	Alien
103	<i>Phyllostachys nigra</i>	Black Bamboo		Grass	Plantae	Alien
104	<i>Phyllostachys reticulata</i>	Madake, giant timber bamboo		Grass	Plantae	Alien
105	<i>Pineus pini</i>	Hill raspberry	Mwiba, Msha	Insect	Animalia	Alien
106	<i>Pinus caribaea</i>	Caribbean Pine,	Msindano	Tree	Plantae	Alien
107	<i>Pinus patula</i>	Spreading-leaved pine	Msindano	Tree	Plantae	Alien
108	<i>Pinus radiata</i>	Peruvian pepper	Msindano	Tree	Plantae	Alien
109	<i>Piper hispidum</i>	Brazilian fern tree		Tree	Plantae	Alien
110	<i>Poecilia reticulata</i>	Guppy		Fish	Animalia	Alien
111	<i>Polygala paniculata</i>	Island snake-root		Herb	Plantae	Alien
112	<i>Procambarus clarkii</i>	Red swamp crawfish		Fish	Animalia	Alien
113	<i>Protocentrum arenarium</i>	Common yellow everlasting		Herb	Plantae	Alien
114	<i>Psidium guajava</i>	Common guava	Mpera	Shrub	Plantae	Alien
115	<i>Psidium guineense</i>	Sour guava	Mpera pori	Tree	Plantae	Alien
116	<i>Pyrostegia venusta</i>	Flame vine		Climber	Plantae	Alien
117	<i>Quelea quelea</i>	Red-billed weaver		Bird	Animalia	Native
118	<i>Ricinus communis</i>	Castor oil plant		Shrub	Plantae	Alien
119	<i>Rubus rosifolius</i>	Hill raspberry		Shrub	Plantae	Alien
120	<i>Saccharum officinarum</i>	Sugarcane		Grass	Plantae	Alien
121	<i>Sacciolepis indica</i>	Glen oodgrass		Grass	Plantae	Alien
122	<i>Salmo trutta</i>	brown trout		Fish	Animalia	Alien
123	<i>Schinus molle</i>	Bronze bug		Tree	Plantae	Alien
124	<i>Schizolobium parahyba</i>	Brazilian fern tree		Tree	Plantae	Alien
125	<i>Schizostachyum dullooa</i>			Grass	Plantae	Alien
126	<i>Selaginella biformis</i>			Fern	Plantae	Alien
127	<i>Senna multijuga</i>	Golden shower		Shrub	Plantae	Alien
128	<i>Senna siamea</i>	Siamese cassia	Mjoholo	Tree	Plantae	Alien
129	<i>Sonchus asper</i>	Prickly sow-thistle		Herb	Plantae	Alien
130	<i>Spathodea campanulata</i>	African tuliptree	Kifabakazi	Tree	Plantae	Native
131	<i>Spondias mombin</i>	Yellow mombin or hog plum		Tree	Plantae	Alien
132	<i>Stachytarpheta jamaicensis</i>	Blue porterweed		Herb	Plantae	Alien
133	<i>Stachytarpheta urticifolia</i>	Nettleleaf velvetberry		Herb	Plantae	Alien

S/N	Scientific name	Common name	Local Name	Life form	Organism	Alien/ Native
134	<i>Syzygium aromaticum</i>	Clove		Tree	Plantae	Alien
135	<i>Syzygium jambos</i>	Champakka, Mountain Apple		Tree	Plantae	Alien
136	<i>Syzygium malaccense</i>	Malay rose apple		Tree	Plantae	Alien
137	<i>Tectona grandis</i>	Teak	Mtiki	Tree	Plantae	Alien
138	<i>Thaumastocoris peregrinus</i>	Bronze bug		Insect	Animalia	Alien
139	<i>Theobroma cacao</i>	Cocoa tree		Tree	Plantae	Alien
140	<i>Thunbergia grandiflora</i>	Blue skyflower		Herb	Plantae	Alien
141	<i>Toona ciliata</i>	Red cedar	Msederera-toona	Tree	Plantae	Alien
142	<i>Tridax procumbens</i>	Coat Buttons		Herb	Plantae	Alien
143	<i>Verbena bonariensis</i>	clustertop vervain		Herb	Plantae	Alien
144	<i>Verbena officinalis</i>	Common verbena		Herb	Plantae	Alien
145	<i>Xanthosoma sagittifolium</i>	Arrowleaf elephant's ear		Herb	Plantae	Alien

Reporter's name/Organization: Contacts:
Reporting level (e.g. Kitongoji, Village, Ward, District etc.):
Date: Time:

PA= Protected Areas (National Parks, Game Reserves, Wildlife Management Area, Ngorongoro Conservation Area), WL= Wetlands, FR= Forests, PL= Pasture Land, AL= Agricultural Land and WB= Water Bodies

Appendix 12: A list of priority invasive species for management in Tanzania as ranked by Stakeholders

Sector	Species rank	Scientific name	Common name
Agriculture		A. Arthropod pests	
	1	<i>Spodoptera frugiperda</i>	Fall armyworm
	2	<i>Tuta absoluta</i>	Tomato Leaf Miner
	3	<i>Bactrocera dorsalis</i>	Fruit flies
	4	<i>Aleurodicus disperses</i>	Spiralling Whitefly
	5	<i>Chilo partellus</i>	Spotted Stem borers
	6	<i>Busseola fusca</i>	Stem borers
	7	<i>Paracoccus marginatus</i>	Pawpaw mealybug
	8	<i>Plutela xylostella</i>	Diamond Backmoth
	9	<i>Mononychellus tanajoa</i>	Green Spider Mites
	10	<i>Tetranychus urticae</i>	Red Spider Mites
	11	<i>Thaumatotibia leucotreta</i>	False Codling Moth
	12	<i>Melanaphis sacchari</i>	Sugarcane Aphid
	13	<i>Toxoptera citricida</i>	Citrus black aphid
		B. Diseases	
	1	<i>Maize Lethal Necrosis (MLN)</i>	Maize Lethal Necrosis (MLN)
	2	<i>Aspergillus flavus</i>	Aflatoxin causing fungi)
	3	<i>Xanthomonas campestris</i>	Banana Xanthomonas Wilt (BXW)
	4	<i>Fusarium oxysporum</i>	FOC TR4
	5		<i>Cassava Brown Streak Virus (CBSV)</i>
		C. Weeds	
	1	<i>Striga asiatica</i>	Witch weed, Striga weed
	2	<i>Parthenium hysterophorus</i>	Carrot weed
	3	<i>Astripomea hyoscyamoides</i>	Kongwa weed
	4	<i>Chromolaena odorata</i>	Siam weed
	5	<i>Mimosa diplotricha</i>	Nila grass
	6	<i>Prosopis juliflora</i>	Prosopis
	7	<i>Argemone Mexicana</i>	Mexican poppy
	8	<i>Datura stramonium</i>	Thorn aple
	9	<i>Tagetes minuta</i>	Marigold
		D. Mammals	
	1	<i>Rattus rattus</i>	House rat
Livestock	1	<i>Astripomea hyoscyamoidse</i>	Kongwa weed
	2	<i>Chromolaena odorata</i>	Siam weed
	3	<i>Gutenbergia cordifolia</i>	Gutenbergia
	4	<i>Eleusine jaegeri</i>	Goosegrass
	5	<i>Lantana camara</i>	Tickberry, Lantana
	6	<i>Calotropis gigantea</i>	Giant calotrope
	7	<i>Prosopis juliflora</i>	Mesquite

Sector	Species rank	Scientific name	Common name
Water	1	<i>Eichhornia crassipes</i>	Water hyacinth
	2	<i>Pistia stratiotes</i>	Water cabbage
	3	<i>Azolla filiculoides</i>	Wosquito fern
	4	<i>Eucalyptus citriodora</i>	Lemon-scented gum
Transport	1	<i>Corvus splendens</i>	House Crow
	2	<i>Eichhornia crassipes</i>	Water hyacinth
	3	<i>Pistia stratiotes</i>	Water cabbage
	4	<i>Parthenium hysterophorus</i>	Whitetop weed
	5	<i>Cosmos sulphureus</i>	Wellow cosmos
Works	1	<i>Calotropis procera</i>	Rubber bush
	2	<i>Calotropis gigantea</i>	Crown flower
	3	<i>Dolichandra unguis-cati</i>	Cats claw creeper
	4	<i>Erigeron karvinskianus</i>	Mexican fleabane
Forestry	1	<i>Lantana camara</i>	Tickberry, Lantana
	2	<i>Parthenium hysterophorus</i>	White top
	3	<i>Datura stramonium</i>	Thorn aple
	4	<i>Argemone mexicana</i>	Mexican Prickly Poppy
	5	<i>Caesalpinia decapitala</i>	Cat's claw
	6	<i>Tagetes minuta</i>	Marigold
	7	<i>Bidens pilosa</i>	Blackjack
	8	<i>Chromolaena odorata</i>	Siam weed
	9	<i>Eleusine jaegeri</i>	Goosegrass
	10	<i>Gutenbergia cordifolia</i>	Gutenbergia
	11	<i>Senna siamea</i>	Cassia tree
Wildlife	12	<i>Senna spectabilis</i>	Weeping Cassia
	13	<i>Amaranthus hybridus</i>	Green amaranth
	14	<i>Acacia mearnsii</i>	Black wattle
	15	<i>Astripomoea hyoscyamoides</i>	Kongwa weed
	16	<i>Datura metel</i>	Thorn Apple, Angel's Trumpet
	17	<i>Maesopsis eminii</i>	Umbrella tree
	18	<i>Cinara cupressi sensu lato</i>	Cypress aphid
	19	<i>Arenga pinnata</i>	Black sugar palm
	20	<i>Pineus pini</i>	Pine woolly aphid
	21	<i>Castilla elastica</i>	Panama rubber tree
	22	<i>Manihot carthaginensis</i>	Tree cassava
	23	<i>Leptocybe invasa</i>	Blue gum chalcid
	24	<i>Azadirachta indica</i>	Neem Tree
	25	<i>Ricinus communis</i>	Castor bean/oil plant
	26	<i>Tridax procumbens</i>	Coat Buttons
	27	<i>Verbena officinalis</i>	Prostrate verbena
	28	<i>Acacia zanzibarica</i>	Mpiga mururu
	29	<i>Mimosa pudica</i>	Shameplant
	30	<i>Opuntia monacantha</i>	Drooping Prickly Pear

Sector	Species rank	Scientific name	Common name
	31	<i>Bidens schimperi</i>	Black jack
	32	<i>Solanum incanum</i>	Thorn apple
	33	<i>Leucaena leucocephala</i>	White leadtree
	34	<i>Lates niloticus</i>	Nile perch
	35	<i>Eichhornia crassipes</i>	Water hyacinth
	36	<i>Dolichandra unguis-cati</i>	Cats claw creeper
Health	1	<i>Parthenium hysterophorus</i>	Whitetop weed
	2	<i>Culex quinquefasciatus</i>	Southern house mosquito
	3	<i>Rattus rattus</i>	Black rat
	4	<i>Corvus splendens</i>	Indian house crow
Fisheries	1	<i>Eichhornia crassipes</i>	Aquatic
	2	<i>Acanthaster planci</i>	Starfish (COTS)
	3	<i>Procambarus clarkii</i>	Crayfish
	4	<i>Musculista senhousia</i>	Mussel
	5	<i>Mnemiopsis leidyi</i>	Jellyfish
	6	<i>White spot syndrome virus (WSSV)</i>	White spot syndrome (Viral disease)
	7	<i>Amphidinium carterae</i>	Dinoflagellate
	8	<i>Oreochromis niloticus</i>	Tilapia
	9	<i>Kappaphycus spp</i>	Seaweed
	10	<i>Lates niloticus</i>	Nile perch

Appendix 13: A list of priority invasive species for management as ranked by Task Force Team members.

Sector	Ranks by sector	Scientific name	Common name
Agriculture	1	<i>Spodoptera frugiperda</i>	Fall armyworm
	2	<i>Tuta absoluta</i>	Tomato Leaf Miner
	3	<i>Bactrocera dorsalis</i>	Oriental fruit fly
	4	<i>Aleurodicus disperses</i>	Spiralling Whitefly
	5	<i>Xanthomonas campestris</i>	Banana Xanthomonas Wilt (BXW)
	6	<i>Fusarium oxysporum f.sp. cubense</i>	
	7	<i>Maize Lethal Necrosis (MLN)</i>	Maize Lethal Necrosis (MLN)
Livestock	1	<i>Astripomoea hyoscyamoidse</i>	Kongwa weed
	2	<i>Chromolaena odorata</i>	Siam weed
	3	<i>Gutenbergia cordifolia</i>	Gutenbergia
	4	<i>Eleusine jaegeri</i>	goosegrass
	5	<i>Prosopis juliflora</i>	Mrashia
Water	1	<i>Eichhornia crassipes</i>	Water hyacinth
	2	<i>Azolla filiculoides</i>	mosquito fern
	3	<i>Trapa natans</i>	
	4	<i>Eucalyptus citriodora</i>	
	5	<i>Eucalyptus globulus</i>	
Transport	1	<i>Corvus splendens</i>	Indian house Crow
	2	<i>Eichhornia crassipes</i>	water hyacinth
	3	<i>Parthenium hysterophorus</i>	whitetop weed
Works	1	<i>Calotropis procera</i>	Rubber bush
	2	<i>Calotropis gigantea</i>	crown flower
Wildlife	1	<i>Chromolaena odorata</i>	
	2	<i>Gutenbergia cordifolia</i>	
	3	<i>Eleusine jaegeri</i>	
	4	<i>Parthenium hysterophorus</i>	
	5	<i>Caesalpinia decapitala</i>	
	6	<i>Acacia zanzibarica</i>	
	7	<i>Acacia mearnsii</i>	
	8	<i>Maesopsis eminii</i>	
	9	<i>Leptocybe invasa</i>	
	10	<i>Cinara cupressi sensu lato</i>	

Sector	Ranks by sector	Scientific name	Common name
Forest	1	<i>Leptocybe invasa</i>	
	2	<i>Lantana camara</i>	
	3	<i>Cedrella odorata</i>	
	4	<i>Acacia mearnsii</i>	
	5	<i>Thaumastocoris peregrinus</i>	
Health	1	<i>Parthenium hysterophorus</i>	whitetop weed
	2	<i>Ratus rattus</i>	black rat
	3	<i>Corvus splendens</i>	Indian house crow
Fisheries	1	<i>Eichhornia crassipes</i>	Aquatic
	2	<i>Acanthaster planci</i>	Starfish (COTS)
	3	<i>Procambarus clarkia</i>	Crayfish
	4	<i>Musculista senhousia</i>	Mussel
	5	<i>Mnemiopsis leidyi</i>	Jellyfish

Appendix 14: Evaluation Plan Matrix on Construction to sync with the strategy flow

Goal 1: To have in place effective and adequate regulatory and management frameworks for the prevention and combating Invasive Species countrywide				
Objective 1.1: Mainstreaming Invasive Species management issues into Regulatory Frameworks				
Strategies and Activities	Indicators	Evaluation Tools	Timeframe	Responsibility
Review regulatory tools and mainstream Invasive Species	Process Indicators Strategies delivered within allocated time	Quantitative Methods: Records of implementation • Minutes and reports of meetings • Tools developed and updated	By 2022	Ministries responsible for Environment, Livestock, Fisheries, Forest, Wildlife, Tourism, Agriculture, Trade and Industries, Water, Land, Human Settlements, Education & Vocational Training, Communication, Science and Technology, Food, Transport, Infrastructure, Deep Sea, Immigration, Works, Health and Social Welfare, Finance, Academic and Research Institutions, LGA's, Private Sector, NGO
Harmonize conflicting regulatory tools	# of meetings conducted	Stakeholders feedbacks forms (satisfaction, awareness, knowledge and intention to adopt/change)	End of the Strategy	
Develop effective management tools for managing IS issues national wide	# of regulatory and management tools developed and updated	Pre and Post stakeholders evaluation survey (satisfaction, awareness, knowledge and intention to adopt/change)	Beginning and End of the Strategy	
Mainstream invasive species issues into local charters, plans and guidelines of sectoral ministries, local government and private sector	# of resolved conflicts # of offenders and exhibits Agencies satisfied with defined roles and responsibilities	Qualitative Methods: Review process with CEO's and employees of implementing agencies through Focus Group or In-Depth Interview (Satisfaction, Barriers to Participate, Preferred Communication Channels and Areas of Improvement)	End of the Strategy	
Identify and capacitate agencies responsible for enforcement of regulatory tools on invasive species	Impact Indicators # of stakeholders reporting use of IS regulatory framework # of stakeholders reporting use of IS management framework			
Develop risk assessment process for effective enforcement of regulatory tools	Outcome Indicator Mainstreamed IS issues in regulatory and management frameworks			
Define roles and responsibilities of all agencies responsible for regulating invasive species				

Objective 1.2: Develop and equip multi-sectoral committees and or organs at national, regional and district levels of guiding, planning and implement actions on IS				
Strategies and Activities	Indicators	Evaluation Tools	Timeframe	Responsibility
Establish and maintain invasive species national, regional and district level multi-sectoral organs	Process Indicators Strategies delivered within allocated time # of meetings conducted # of IS multi-sectoral organs established countywide % of budget allocated and spent Local action identified and implemented Impact Indicators # of stakeholders satisfied with IS framework Outcome Indicator Increased stakeholders involvement at national, regional and district level	Quantitative Methods: Records of implementation - Minutes and reports of meetings - Actions developed and implemented - Records of financial resources Pre and Post stakeholders evaluation survey (satisfaction, awareness, knowledge and intention to adopt/change) Qualitative Methods: Review process through In-Depth Interview (Satisfaction, Barriers to Participate, Preferred Communication Channels and Areas of Improvement)	Beginning and end of the Strategy Beginning and End of the Strategy Beginning and End of the Strategy	Ministries responsible for Environment, Fisheries, Forest, Wildlife, Tourism, Agriculture, Trade and Industries, Water, Land, Human Settlements, Education & Vocational Training, Communication, Science and Technology, Food, Transport, Infrastructure, Deep Sea, Immigration, Works, Health and Social Welfare, Finance, LGA's, Private Sector, NGO
Facilitate invasive species national, regional and district level multi-sectoral organs to develop and implement local invasive species strategies and action plans				
Objective 1.3: Strengthen and promote strong collaboration and co-ordination with stakeholders on the management of IS				
Strengthen trans-boundary partnerships	Process Indicators Strategies delivered within allocated time # of meetings & workshops conducted Collaboration framework in place List of cross border partners # of MoU Signed	Quantitative Methods: Records of implementation - Minutes of meetings - Reports of Workshops & Partnerships - Actions developed and implemented - Records of financial resources	End of the Strategy	Ministries responsible for Environment, East Africa Cooperation, LGA's, Private Sector, NGO
Establish coordination and communication mechanism for effective management of IS for all relevant stakeholders				
Develop and implement effective system for collaboration among stakeholders				

Strategies and Activities	Indicators	Evaluation Tools	Timeframe	Responsibility
Develop and implement framework for coordination among stakeholders	# of involved countries # of forums established	Pre and Post stakeholders evaluation survey (satisfaction, awareness, knowledge and intention to adopt/change)	Beginning and End of the Strategy	
Evaluate cross-sectoral coordination and collaboration	Amount of funds raised from partnerships	Qualitative Methods: Review process through In-Depth Interview (Satisfaction, Barriers to Participate, Preferred Communication Channels and Areas of Improvement)	Beginning and End of the Strategy	
Develop and implement a framework for quarterly reporting	Impact Indicators # of stakeholders satisfied with collaborations and coordination			
Leverage funds to address IS management objectives	Outcome Indicator Increased stakeholders involvement at national, regional and district level			
Develop fund distribution guidelines for managing IS				
Establish an emergency response funding model				
Goal 2: To develop and open rationalize mechanisms and systems of generating knowledge (research) with support mechanism of disseminating and use (public outreach) of information on IS				
Objective 2.1: Enhance national capacity in research and management on IS				
Mainstream IS into existing research agenda of academic, research and development institutions	Process Indicators Strategies delivered within allocated time # of IS research agenda	Quantitative Methods: Records of implementation • Minutes of meetings • Reports of implementation • Researches implemented • Records of financial resources	Beginning and End of the Strategy	Ministries responsible for Environment, Livestock, Fisheries, Forest, Wildlife, Tourism, Agriculture, Trade and Industries, Water, Land, Human Settlements, Education & Vocational Training, Communication, Science and Technology, Food, Transport, Infrastructure, Deep Sea, Immigration, Works, Health and Social Welfare, Finance, LGA's, Private Sector, NGO
Establish a national IS research fund	Established IS Research Fund # of IS researches conducted Database of IS information		Beginning and End of the Strategy	
Support research on priority IS issues and areas	Impact Indicators # of stakeholders satisfied with disseminated IS knowledge	Pre and Post stakeholders evaluation survey (satisfaction, awareness)		
Develop a database of research findings	Outcome Indicator Increased knowledge of IS key issues	Qualitative Methods: In-Depth Interview (Satisfaction and Areas of Improvement)		
Strengthen a centralized national biodiversity database				

Objective 2.2: Generate, update and make available baseline information of IS and native species, pathways and sensitive sites national wide				
Strategies and Activities	Indicators	Evaluation Tools	Timeframe	Responsibility
Compile database and other information resources on native and invasive species, susceptible sites and sensitive sites	Process Indicators Strategies delivered within allocated time # of IS information resources	Quantitative Methods: Records of implementation • Reports of implementation • Surveys conducted • Records of financial resources	Beginning and End of the Strategy	Ministries responsible for Environment, Livestock, Fisheries, Forest, Wildlife, Tourism, Agriculture, Trade and Industries, Water, Land, Human Settlements, Education & Vocational Training, Communication, Science and Technology, Food, Transport, Infrastructure, Deep Sea, Immigration, Works, Health and Social Welfare, Finance, LGA's, Private Sector, NGO
Identify and document pathways and vectors of introduction of IS and potentially IS	Database of IS information # of surveys conducted # of published and shared information tools	Pre and Post stakeholders evaluation survey (satisfaction, awareness)	Beginning and End of the Strategy	
Periodically carryout priority surveys and updates information resources	Impact Indicators # of stakeholders satisfied with disseminated IS knowledge	Qualitative Methods: In-Depth Interview (Satisfaction and Areas of Improvement)		
Publish and share information on IS key issues through formal and informal tools such as Policy Briefs, Online systems and other appropriate tools	Outcome Indicator Increased knowledge of IS key issues			
Objective 2.3: Develop awareness programs focusing target groups and active participation of stakeholders at national, sectoral, regional and district leve				
Identify targeted audiences for awareness programs to include decisions-makers, influencers, communities, women, young people, and other groups involved in the implementation of invasive management actions	Process Indicators Strategies delivered within allocated time # of identified target audiences # of community educational and awareness programs implemented	Quantitative Methods: Records of implementation • Reports of implementation • Records of financial resources • IS workers and extension service providers satisfied with training and capacity building programs	End of the Strategy	Ministries responsible for Environment, Livestock, Fisheries, Forest, Wildlife, Tourism, Agriculture, Trade and Industries, Water, Land, Human Settlements, Education & Vocational

Strategies and Activities	Indicators	Evaluation Tools	Timeframe	Responsibility
Develop and implement community educational and awareness programs for increasing awareness on the pride of native species and ecosystem, and the damage of the IS	# of IS key issues covered by the national communication strategy # of training and capacity building conducted to IS workers and extension service providers # of school and college curriculum covering IS issues	Pre and Post stakeholders evaluation survey (satisfaction, awareness) Qualitative Methods: In-Depth Interview (Satisfaction and Areas of Improvement)	Beginning and End of the Strategy Beginning and End of the Strategy	Training, Communication, Science and Technology, Food, Transport, Infrastructure, Deep Sea, Immigration, Works, Health and Social Welfare, Finance, LGA's, Private Sector, NGO
Mainstream invasive species management into national communication strategy	# of exemplary performer in invasive species management identified and rewarded			
Promote behavioural change to mitigate introduction and spread of invasive species	# of national and international environment events conducted			
Provide training in developing media campaigns to invasive species workers at national, regional and district level	# of IS messaging platforms created Impact Indicators # of community satisfied with implementation of combating the spread and emergence of IS Outcome Indicator Increased level of awareness among stakeholders and members of community			
Mainstream invasive species into the formal education sector from primary, secondary to tertiary higher learning institutions through the development of school and college curriculum development				
Strengthen technical capacity of extension service providers				

Strategies and Activities	Indicators	Evaluation Tools	Timeframe	Responsibility
Recognize exemplary performance in invasive species management at national, regional and district levels				
Incorporate invasive species management into national and international environment events				
Create consistent and timely messaging platforms on invasive species				
Goal 3: Effective systems are in place to combat and prevent the spread of Invasive Species from all potential sources/causes				
Objective 3.1: Prevent pathways to introduction and spread of IS				
Identify and manage priority pathways and vector spread	Process Indicators Strategies delivered within allocated time	Quantitative Methods: Records of implementation • Reports of implementation • Records of financial resources Pre and Post stakeholders evaluation survey (satisfaction, awareness) Qualitative Methods: In-Depth Interview (Satisfaction and Areas of Improvement)	End of the Strategy Beginning and End of the Strategy Beginning and End of the Strategy	Ministries responsible for Environment, Livestock, Fisheries, Forest, Wildlife, Tourism, Agriculture, Trade and Industries, Development Partners, Private Sector, Research Institutions, LGAs, NGOs
Strengthen risk assessment processes	# of entry points conducting inspections			
Strengthen and regulate importation and movement of live materials at national and regional borders	Risk assessment protocols in place			
Strengthen and support border posts with adequate resources to manage IS	EDRR procedures in place			
Develop Early Detection and rapid Response (EDRR) procedures	# and types of inspections conducted			
Develop and implement a national surveillance system	# of species recorded at entry points			
Develop IS "Watch Lists	Impact Indicators Reduced environmental hazards Improved health conditions Improved economical gain Increased community satisfaction Outcome Indicator Increased level of security against IS			

Objective 3.2: Implement effective control, restoration and monitoring programs				
Identify, map and manage established IS	Process Indicators	Quantitative Methods:	End of the Strategy Beginning and End of the Strategy	Ministries responsible for Environment, Livestock, Fisheries, Forest, Wildlife, Tourism, Agriculture, Trade and Industries, Water, Land, Human Settlements, Education & Vocational Training, Communication, Science and Technology, Food, Transport, Infrastructure, Deep Sea, Immigration, Works, Health and Social Welfare, Finance, LGA's, Private Sector, NGO, Development Partners
Building on the management know-how from within and other countries	Strategies delivered within allocated time # of IS Distribution Maps	Records of implementation • Reports of implementation • Records of financial resources Pre and Post stakeholders evaluation survey (satisfaction, awareness)	End of the Strategy	
Develop and promote integrated approaches to control IS	IS restoration framework in place # of IS identified and controlled # of areas restored	Qualitative Methods: In-Depth Interview (Satisfaction and Areas of Improvement)	Beginning and End of the Strategy	
Integrate restoration options in all IS restoration areas	# of IS controlled using IPM approaches			
Develop a framework for IS restoration	# of adopted management know-how			
Guide and support restoration efforts and actions national wide	# of websites, portal and database established Protocols reviewed and updated M&E Evaluation Reports			
Develop and implement a national IS management monitoring and evaluation framework	Impact Indicators Reduced environmental hazards Improved health conditions Improved economical gain Increased community satisfaction			
Improving existing monitoring standards and protocols	Outcome Indicator Increased level of controlling the spread of IS			

Appendix 15: Prioritization of Actions

- 1. Critical Actions** refers to actions that are essential to the successful implementation of the Strategy and should be initiated as soon as possible, within one year of the endorsement of the Strategy. These include:
 - 1.1.1: Review and update existing invasive species regulatory tools
 - 1.1.2: Harmonize existing legislations to address invasive species management under the Environment Management Act of 2004
 - 1.1.3: Incorporation of invasive species issues into local charters, sectorial ministries, local government and private sector plans and guidelines
 - 1.2.1 Identify and enforce regulatory tools on invasive species
 - 2.1.1: Strengthen trans -boundary partnerships
 - 2.1.2: Establish coordination and communication mechanism for all relevant stakeholders
 - 2.2.1 Develop and implement an effective system for and collaboration among stakeholders
 - 2.2.2: Evaluate cross-sectorial coordination and collaboration
 - 2.2.3: Develop and implement a framework for quarterly reporting
 - 3.1.1: Develop fund distribution guidelines for managing invasive species
 - 3.2.3: Carry out research on priority invasive species and areas
 - 4.1.1: Identify and manage priority pathways and vectors of spread
 - 4.2.1: Develop EDRR procedures
 - 4.2.4 Operationalize EDRR
 - 6.1.1: Develop and promote integrated pest management (IPM) to control invasive species
 - 6.1.2: Strengthen a centralized national biodiversity database
 - 6.2.1: Integrate restoration in all invasive species management
 - 6.2.2: Develop a framework for invasive species restoration
- 2. High Priority Actions** are essential to the successful implementation of the Strategy and should also be initiated as soon as possible but in many cases their implementation is contingent upon prior actions being undertaken. These prior actions are classified as critical. These include:
 - 1.2.2: Develop assessment process for effective enforcement of regulatory tools
 - 1.2.3: Define roles and responsibilities for all stakeholders in managing invasive species
 - 1.2.4: Provide incentives for management of invasive species
 - 3.1.2: Leverage funds to address invasive species management objectives
 - 3.1.3: Establish an emergency response funding model
 - 3.2.1 Identify and address invasive species knowledge gaps
 - 3.2.2: Mainstream invasive species into existing research agenda of academic, research and development institutions
 - 4.1.2: Strengthen risk assessment processes
 - 4.3.3: Develop invasive species “watch lists”
 - 5.1.1: Develop and implement community educational and awareness programs on invasive species
 - 5.1.2: Promote behavioural change to reduce spread of invasive species
 - 5.1.3: Mainstream invasive species modules from primary to higher learning institutions
 - 5.1.4: Evaluate stakeholder’s education and awareness on invasive species management
 - 5.1.5: Strengthen technical capacity of Extension Service Providers
 - 5.2.1: Mainstream invasive species management into national communication strategy
 - 5.2.3: Incorporate invasive species management into national and international environmental events
 - 5.3.4: Create consistent and timely messaging platforms on invasive species
 - 6.2.3: Support restoration efforts
 - 6.3.1: Develop and implement a national invasive species management monitoring and evaluation framework
 - 6.3.2 Improve existing monitoring standards and protocols
- 3. Medium Priority Actions** are in some cases contingent upon the undertaking of high priority actions. In other cases, it is deemed that they would be of value but are not essential to the successful implementation of the Strategy. These include:
 - 3.2.4: Investigate on long-term cost of doing nothing
 - 5.2.2: Recognize exemplary performance in invasive species management

Appendix 16: Indicative budget for implementation of NISSAP (2019-2029)

Actions	Number	Unit	Unit cost	Total budget	Budget assumption	Responsible Institution/Ministries/Leading Agency	Budget (TZS x 10 ⁶)									
							2019/2020	2020/2021	2021/2022	2022/2023	2023/2024	2024/2025	2025/2026	2026/2027	2027/2028	2028/2029
OBJECTIVE 1: PREVENT INTRODUCTION AND SPREAD OF INVASIVE SPECIES																
Target 1.1: 90% of quarantine border posts are supported to manage invasive species pathways by 2024																
Action 1.1.1: Identify and manage priority pathways and vectors of IS introduction and spread		lumpsum		1,980,000,000	Involve sectoral ministries and associated authorities		396	396	396	396	396					
Action 1.1.2: Conduct risk assessment of potential IS	20	sector	10,000,000	200,000,000	20 sectors @ TZS 10,000,000	VPO (DoE)	50	50	50	50						
Action 1.1.3: Enforce regulations dealing with importation and movement of live materials at national and regional/ international borders	20	Sector	110,000,000	2,200,000,000	20 sectors @ TZS 110,000,000	VPO (DoE)	440	440	440	440	440					
1.1.4: Capacitate border posts with adequate resources to manage invasive species	1	Consultancy	60,000,000	60,000,000	Hire consultancy for TZS 60,000,000	sectorial ministries, LGAs		20				20				20
			Sub-Total	4,380,000,000		sectorial ministries, LGAs										

Actions	Number	Unit	Unit cost	Total budget	Budget assumption	Responsible Institution/Ministries/Leading Agency	Budget (TZS x 10 ⁶)									
							2019/2020	2020/2021	2021/2022	2022/2023	2023/2024	2024/2025	2025/2026	2026/2027	2027/2028	2028/2029
Target 1.2: At least 95 % of emerging invasions are eradicated by 2029																
Action 1.2.1: Develop and implement EDRR procedures		lumpsum		400,000,000	Involve 1 task force for a TZS 100,000,000; 20 sectors develop I1 watch list for TZS 5,000,000	VPO (DoE), NISTAC	250	150								
Action 1.2.2: Develop and implement a national surveillance system	20	sector	190,000,000	3,800,000,000	Involve 20 sectors forTZS 190,000,000	sectorial ministries, LGAs	380	380	380	380	380	380	380	380	380	380
Action 1.2.3: Develop and disseminate invasive species watch lists		lumpsum		1,000,000,000			100									
			Sub-Total	5,200,000,000		sectorial ministries, LGAs										
			Total	9,580,000,000												
OBJECTIVE 2: IMPLEMENT EFFECTIVE CONTROL, RESTORATION, AND MONITORING PROGRAMS																
Target 2.1 : At least 50% of priority invasive species are effectively controlled by 2029																
Action 2.1.1: Identify, map and reduce abundance of invasive species in their established and invasion areas		Lumpsum	120,000,000	1,200,000,000				120								
Action 2.1.2: Building on the management know-how from within and other countries			10,000,000	10,000,000					10							

NATIONAL INVASIVE SPECIES STRATEGY AND ACTION PLAN (NISSAP)

Actions	Number	Unit	Unit cost	Total budget	Budget assumption	Responsible Institution/Ministries/ Leading Agency	Budget (TZS x 10 ⁶)									
							2019/2020	2020/2021	2021/2022	2022/2023	2023/2024	2024/2025	2025/2026	2026/2027	2027/2028	2028/2029
Target 2.3: At least 50% invasive species management efforts are monitored by 2029																
Action 2.3.1: Develop and implement a national invasive species management monitoring and evaluation framework	5	Consultancy	200,000,000	1,000,000,000	Hire consultant to evaluate for 5 years@ TZS 200,000,000	VPO (DoE)	100					100				
Action 2.3.2: Improve existing monitoring standards and protocols	20	sector	30,000,000	600,000,000	20 sectors @ TZS 30,000,000; Involve Task force@ TZS 30,000,000; Involve Task force@ TZS 30,000,000	VPO (DoE)	60	60	60	60	60	60	60	60	60	60
			Sub-Total	1,600,000,000												
			Total	11,440,000,000												
OBJECTIVE 3: ENHANCE NATIONAL CAPACITY IN MANAGEMENT AND RESEARCH ON INVASIVE SPECIES																
Target 3.1: At least 70% of fund proposed for management of invasive species is secured and implemented by 2024																
Action 3.1.1: Leverage funds to address IS management objectives	70	Task force	500,000	35,000,000	Involve 10 experts for 7mandays @ TZS 500,000	VPO (DoE),	20	15								
Action 3.1.2: Develop fund distribution guidelines for managing invasive species	50	stakeholders	100,000,000	5,000,000,000	50 stakeholders to contribute @ TZS 100,000,00	VPO (DoE), Development partners,	500	500	400	600	700	300	500	500	500	500
Action 3.1.3: Establish an emergency response funding model	20	sector	100,000,000	2,000,000,000	20 sectors to contribute @ TZS 100,000,00	VPO (DoE)	200	200	200	200	200	200	200	200	200	200

Actions	Number	Unit	Unit cost	Total budget	Budget assumption	Responsible Institution/Ministries/Leading Agency	Budget (TZS x 10 ⁶)									
							2019/2020	2020/2021	2021/2022	2022/2023	2023/2024	2024/2025	2025/2026	2026/2027	2027/2028	2028/2029
Target 3.2: : By 2025, research on invasive species increased by 50%																
Action 3.2.1: Action 3.2.1: Support research on priority invasive species and areas	100	sector	20,000,000	10,000,000,000	20 sectors conduct 1 research annually for 5 years @TZS 20,000,000	Research Institution,	200	300	100	100	300	200	200	200	200	200
Action 3.2.2: Mainstream invasive species into existing research agenda of academic, research and development institutions	1	Task force	200,000,000	200,000,000	Involve task force representing sectors for TZS 200,000,000	VPO (DoE)	120	80								
Action 3.2.3: Strengthen National Environment Trust Fund		Lumpsum		2,000,000,000								40				
			Sub-Total	12,200,000,000		Research Institutions, Academic Institutions										
			Total	19,235,000,000												
OBJECTIVE 4: ENHANCE STAKEHOLDER'S EDUCATION, AWARENESS AND PARTICIPATION IN INVASIVE SPECIES MANAGEMENT																
Target 4.1: At least 50% of stakeholders are aware of invasive species by 2029																
Action 4.1.1: Develop and implement community educational and awareness programs on invasive species	20	Sector	5,000,000	100,000,000		NISTAC	50	50								

Actions	Number	Unit	Unit cost	Total budget	Budget assumption	Responsible Institution/Ministries/Leading Agency	Budget (TZS x 10 ⁶)									
							2019/2020	2020/2021	2021/2022	2022/2023	2023/2024	2024/2025	2025/2026	2026/2027	2027/2028	2028/2029
Action 4.1.2: Promote behavioural change to reduce spread of invasive species	20	Sector	10,000,000	200,000,000	20 sectors for a TZS 10,000,000 for a project life span		20	20	20	20	20	20	20	20	20	20
Action 4.1.3: Mainstream invasive species modules curriculum from primary to higher learning institutions	1	Consultancy	50,000,000	50,000,000	Hire consultancy for TZS 50,000,000	VPO (DoE)	50									
Action 4.1.4: Strengthen technical capacity of Extension Service Providers				20,000,000			10					10				
			Sub-Total	430,000,000		NITSAC										
Target 4.2: At least 50% of stakeholders participated in managing invasive species by 2024																
Action 4.2.1: Mainstream invasive species management into national communication strategy	40	Sector	10,000,000	400,000,000	2days meetings for 20 sectors for TZS 10,000,000	NITSAC	200	200								
Action 4.2.2: Recognize exemplary performance in invasive species management	1	Consultancy	10,000,000	10,000,000	Develop SOP				5							5

Actions	Number	Unit	Unit cost	Total budget	Budget assumption	Responsible Institution/Ministries/Leading Agency	Budget (TZS x 10 ⁶)									
							2019/2020	2020/2021	2021/2022	2022/2023	2023/2024	2024/2025	2025/2026	2026/2027	2027/2028	2028/2029
Action 4.2.3: Incorporate invasive species management in national and international environmental events	800	Sector	30,000,000	24,000,000,000	20 sector attend 3 local and 3 international events per annum in 10 years period		2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400
Action 4.2.4: Create consistent and timely messaging platforms on invasive species	1	Consultancy	5,000,000	5,000,000	Develop communication strategy	VPO (DOE)	5									
			Sub-Total	24,415,000,000												
			Total	24,845,000,000		VPO (DOE)										
OBJECTIVE 5: MAINSTREAMING INVASIVE SPECIES INTO REGULATORY TOOLS																
Target 5.1: At least 50% of all regulatory tools are revised and operationalized by 2029																
Action 5.1.1: Review regulatory tools and mainstream invasive species	14	Task Force	200,000,000.00	2,800,000,000	14 regulatory tools, conducted once in 10 years' time at a cost of @ TZS 200,000,000	Key sectoral ministries, VPO (DoE)	900	900	1,000							
Action 5.1.2: Harmonize conflicting regulatory tools	15	Task Force	100,000,000.00	1,500,000,000	15 policies reviewed involving maximum of 20 stakeholders @ TZS 100,000,000	VPO (DoE)		500	500	500						
Action 5.1.3: Mainstream invasive species issues into local charters, sectorial ministries, local government and private sector plans and guidelines	13	Task Force	100,000,000.00	1,300,000,000	13 regulations reviewed involving maximum of 20 stakeholders @ TZS 100,000,000	Key sectoral ministries,		600	400	300						

Actions	Number	Unit	Unit cost	Total budget	Budget assumption	Responsible Institution/Ministries/Leading Agency	Budget (TZS x 10 ⁶)									
							2019/2020	2020/2021	2021/2022	2022/2023	2023/2024	2024/2025	2025/2026	2026/2027	2027/2028	2028/2029
			Sub-Total	5,600,000,000		sectorial ministries, LGAs, Private sector, NGOs, CBOs										
Target 5.2: All existing regulatory tools on invasive species are enforced effectively by -2020																
Action 5.2.1: Identify and capacitate agencies responsible for enforcement of regulatory tools on invasive species	40	Authorities	30,000,000.00	1,200,000,000		VPO (DoE), MNRT	140	120	120	120	120	120	120	120	120	100
Action 5.2.2: Develop risk assessment process for effective enforcement of regulatory tools	40	Authorities	20,000,000.00	800,000,000	Develop SOP for 20 sectors	VPO (DoE)	80	100	60	80	80	80	80	100	80	60
Action 5.2.3: Define roles and responsibilities of all agencies responsible for regulating invasive				-	No cost		0									
			Sub-Total	2,000,000,000		sectorial ministries, LGAs										
			Total	7,920,000,000												
OBJECTIVE 6: STRENGTHEN AND PROMOTE STRONG COLLABORATION AND CO-ORDINATION WITH RELEVANT STAKEHOLDERS ON MANAGEMENT OF INVASIVE SPECIES																
Target 6.1: By 2025, collaboration and coordination among stakeholders increased by at least 50%																
Action 6.1.1: Strengthen trans - boundary partnerships	9		50,000,000	450,000,000	Bordering Nations (Kenya, Uganda, Burundi, Rwanda, DRC, Zambia, Mozambique, and Malawi)	VPO (DoE)	45	45	45	45	45	45	45	45	45	45

NATIONAL INVASIVE SPECIES STRATEGY AND ACTION PLAN (NISSAP)