Strategy for Managing Invasive Species in Africa

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Cover photo: Fall armyworm, *Spodoptera frugiperda*. Photo courtesy of G. Goergen, IITA.

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Abbreviations and Acronyms

AU	African Union
CABI	CAB International
CBD	Convention on Biological Diversity
CITES	Convention for International Trade in Endangered Species of Wild Fauna and Flora
DREA	Department of Rural Economy and Agriculture
FAO	Food and Agriculture Organization
FARA	Forum for Agricultural Research in Africa
GIASIS	Global Invasive Alien Species Information System
GISP	Global Invasive Species Programme
IAS	Invasive Alien Species
IBAR	Inter-African Bureau of Animal Resources
icipe	International Centre of Insect Physiology and Ecology
IITA	International Institute of Tropical Agriculture
IPPC	International Plant Protection Convention
IAPSC	Inter-Africa Phytosanitary Council
IS	Invasive Species
ISSG	Invasive Species Specialist Group
IUCN	International Union for Conservation of Nature
NBSAP	National Biodiversity Strategy and Action Plan
R4D	Research for Development
SPS	Agreement on Sanitary and Phytosanitary Measures
SSA	Sub-Saharan Africa
UN	United Nations
UNEP	United Nations Environment Programme
WHO	World Health Organization
WTO	World Trade Organization

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Preface

Invasive species destroy livelihoods, cause hunger, threaten the economic prosperity of entire countries and regions, and increase biodiversity loss. The increasing frequency of invasions of invasive species in Africa suggests that many countries lack adequate capacity to detect and implement management measures. To effectively address the invasive species menace in sub-Saharan Africa (SSA), a shift in strategy from a reactive to a more proactive intervention is urgently needed to be adopted based on the internationally recognised three-stage approach of prevention, early detection, and control.

A proactive, effective approach for managing invasive species in SSA will require: 1) stronger phytosanitary capacity and systems; 2) continent and nationwide surveillance, and integration of invasive species threats into national disaster response units; 3) interdisciplinary and cross border research to develop and deploy novel solutions; and 4) collaborative resource mobilisation, as well as crowd-sourcing and citizen science. This requires a systematic, coordinated, consolidated, proactive and sufficiently financed national, regional and international strategy to mitigate the threats from invasive species. Thus, a strategy for managing invasive species in SSA is vital, to ensure coordination and prioritisation of all relevant issues, as well as effective and continuous partnerships and dialogue among all stakeholders.

At global level, the challenge of invasive species is recognised as significant and the United Nations (UN) declared 2011-2020 as the Decade on Biodiversity. Subsequent to the commitment, global frameworks such as the Sustainable Development Goals (SDGs), Convention on Biological Diversity (CBD) through its Aichi Biodiversity Targets made provisions for needed actions to among others "Encourage Parties to promote the United Nations Decade on Biodiversity in ways appropriate to national circumstances, for example, Protection of Mother Earth, to create dialogues and to share experiences" on invasive species.

Mango mealybug, *Rastrococcus invadens*. Photo courtesy of G. Goergen, IITA.

At the continental level, the most comprehensive strategies that make an effort to address the challenge of invasive species are that of the AU IAPSC which focus on only invasive pests of plants, despite the broad range of Invasive species, the AU Continental SPS Policy Framework under the Sub-regional and continental-level frameworks, and the strategy of AU-IBAR that focuses on Transboundary Animal Diseases and Zoonoses.

Africa lacks a functional and well-coordinated mechanism intended to secure instruments required for vigilance, predictive modelling, forecasting, monitoring/surveillance, data handling, institutional arrangements and governance structures. This mechanism is needed for prevention and or exclusion, preparedness and early detection, and control and management of invasive species as well as restoration and rehabilitation from negative impacts of invasive species. A comprehensive framework and strategy on managing invasive species at continental level is lacking to coordinate the efforts from Member States to achieve their global targets for sustainable development.

This strategy on managing invasive species is developed to respond to this complex invasive species challenge with interventions that link preservation of biodiversity with protection of the health and livelihood of the African human population.

Executive Summary

Invasive species pose a huge global threat, both in terms of biodiversity and the cost to economic activities such as agriculture, trade, tourism and development. Invasive species disproportionately affect communities in poor rural areas; people who depend on natural resources and healthy ecosystems to make a living. For example, invasive insect pests and diseases can significantly affect agricultural productivity and production. An invasive weed can take over agricultural land and outcompete food and feed crops for limited resources. Invasive species can also harm the health of people in infected areas. This can be both direct (allergies, interaction with disease vectors) and indirect (reduced agricultural productivity).

Over half of the worlds food comes from just three crops - rice, wheat and maize. Centre for Agriculture and Biosciences International (CABI) estimates that these three crops alone suffer annual yield losses of up to 16% (i.e. US$96,000 million of lost production) due to invasive species (CABI, 2019)[1]. Invasion of fall armyworm in 12 African countries is estimated to cause annual yield loss of 4.1 to 17.7 million tons of maize crop alone. It is estimated that 480,000 invasive species have been introduced to different ecosystems globally. Unfortunately, their geographic spread and impact is growing due to climate change, trade and tourism. There has been an unprecedented rate of new introductions in recent years, as well as a rapid expansion of existing biological invasions. The impacts of invasive species on biodiversity are well established except in Africa. Some of the impacts include decreased abundance and diversity of native species in invaded sites resulting in changes in communities.

Fall armyworm, *Spodoptera frugiperda eggs*. Photo courtesy of R.S. Copeland, *icipe.*

1 CABI, 2019, Invasive Species: The hidden threat to sustainable development. Accessed from https://www.invasive-species.org/wp-content/uploads/sites/2/2019/02/Invasive-Species-The-hidden-threat-to-sustainable-development.pdf

These impacts have implications for ecosystem services and human well-being. To avert these undesired impacts, it is very critical to establish and implement frameworks and actions for managing invasive species. The vision, goal and objectives are highlighted below.

The **vision** which is entrenched in the African Union (AU) is to effectively contribute to attainment of continental (Agenda 2063) and global (CBD and SDG Targets) aspirations to achieve sustainable development.

The **goal** is to support, enable or add value to strategies/responses of member states at the continental level under the umbrella of the AU mechanisms for ensuring prevention/exclusion, preparedness, early detection, control and management of invasive species; and restoration and rehabilitation from biological invasions.

The current legal regime and strategies at national, sub-regional and continental level do not adequately address the steadfast challenge of invasive species that is gradually eroding and undermining biodiversity in Africa. At the continental level, the most comprehensive strategies that make effort to address the challenge of invasive species are that of the AU IAPSC (African Unions Inter-African Phytosanitary Council), the AU Continental SPS Policy Framework under the sub-regional and continental-level frameworks, and the strategy of AU-IBAR (The African Union-Inter African Bureau for Animal Resources) that focuses on Transboundary Animal Diseases and Zoonoses. But Africa lacks a functional and well-coordinated mechanism intended to secure instruments required for vigilance, predictive modelling, forecasting, monitoring/surveillance, data handling, institutional arrangements and governance structures. This mechanism is needed for prevention and or exclusion, preparedness

and early detection, control and management of invasive species; and restoration and rehabilitation from invasive species impacts.
The lack of a comprehensive framework and strategy on invasive species at continental level to coordinate Member States has resulted in limited progress on achievement of global targets. This strategy is developed to respond to the complex invasive species challenge with interventions that link preservation of biodiversity with protection of the health and livelihood of the Africa's human population.

The **overall objective** of the strategy is to effectively guide and coordinate actions at the continental, regional and national levels towards prevention and eradication of invasive species in Africa.

More specifically, the strategy for managing invasive species in Africa, with its Strategic Result Areas and Actions Framework (SRAAF) containing six strategic objectives, aims to **achieve** the following:

1) Identify, strengthen strategies and mitigate the risk of introduction, establishment and dispersal of invasive species;
2) Establish programmes for rapid control/ eradication of invasive species populations, to eliminate or minimize their negative impacts on ecosystems and conservation efforts;
3) Strengthen public, private sector and civil society engagement to collectively prevent, control and eradicate invasive species;
4) Establish continental, regional and national level emergency funding mechanisms to facilitate rapid action against invasives;
5) Foster research for development (R4D) efforts in all elements of invasive species management including preparedness, predictive modelling, forecasting, monitoring/surveillance, data handling and governance structure and institutional arrangements; and
6) Strengthen effective coordination of invasive species management and support effective phytosanitary and regulatory systems and enabling policies.

The strategy and interventions/ activities in line with the vision and objectives are intended to secure instruments required for surveillance, predictive modelling, forecasting, monitoring/surveillance, data handling, institutional arrangements and governance structures. It is envisioned to have mechanisms and interventions for appropriate prevention and/or exclusion, early detection, control and management; and restoration and rehabilitation to avert the negative impacts from invasive species in Africa.

Famine weed, *Parthenium hysterophorus*. Photo courtesy of Sevgan Subramanian, *icipe*.

1.0 Concept of invasive species and background to the development of this strategy

1.1 Invasive Species vs. Invasive Alien (Exotic) Species

The phrases "Invasive species" and "Invasive alien (exotic) species" (IAS) are most of the times used interchangeably and considered as synonymous. For the purpose of clarity it is important to establish common ground and have clear definitions (**See Annex 1**) to define the scope of the strategy.

Invasive species: These are species which come from another ecosystem and establish in new environments. They establish and thrive mainly because no indigenous/native natural enemies are effective in their regulation immediately or in the long-term enabling the invasive to thrive, expand exponentially and start to out-compete the local, native species. In extreme cases, the invasives, especially invasive weeds, wipe out the competing native species and emerge as a major threat to biodiversity.

Invasive alien species (IAS): These are species that have arrived from another ecosystem and are now in a new environment. They may die out because they are not suited for this new habitat and have natural enemies that maintain them from establishing fully in a new environment. They may find a new niche, grow slowly (if at all), but not overtake the native species with which IAS might compete.

All alien species are not invasive and all invasive species are not alien. For the purposes of this strategy, we refer to both invasive species and invasive alien species as **invasive species**.

Under Global Invasive Species Programme (GISP) Phase I, Richardson et al. (2000)[2] developed the simple concept of the invasion process as shown in Fig. 1 (here adapted to all invasive species rather than only plants). Following this scheme, invasion is a process requiring a taxon to overcome various abiotic and biotic barriers. Phases of the process can be defined on the basis of the relevant barrier(s) that are (or are not) overcome. **Introduction** means that the species (or its propagule) has overcome, through human activity (Fig. 1), a major geographic barrier (A in Fig. 1). **Establishment** begins when environmental barriers (B) do not prevent individuals from surviving and when various barriers to regular reproduction (C) are overcome; and a taxon has become established after overcoming barriers A, B and C. At this stage populations are sufficiently large that the probability of local extinction due to chance of environmental events is low (McNeely et al., 2001)[3]. Spreading of a species into areas away from initial sites of introduction requires that the introduced species also overcome barriers to dispersal within the new region (D) and can cope with the abiotic environment and biota in the general area (E). Many invasive species appear to first colonize disturbed habitats and some of these spread into semi

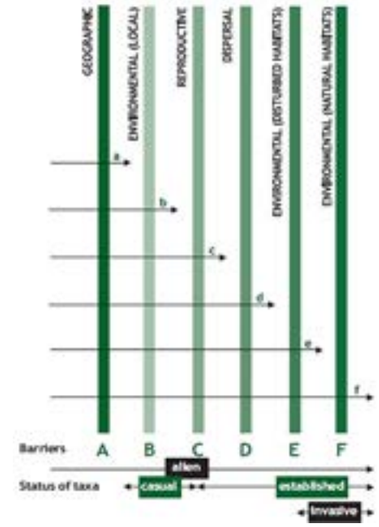

Figure 1. A schematic representation of major barriers limiting the spread of introduced plants

natural communities. The colonization of mature, successional relatively undisturbed communities usually require that the alien taxon overcomes resistance posed by a different category of factors (barrier F in Fig. 1). Every invasive species that becomes established alters the composition of native biological communities in some way. Whether it becomes invasive (and thus harmful) depends on the particular characteristics of the invasive species, the vulnerability of the host ecosystem and chance. The changes to the state of ecosystems may be initiated by natural disturbance (storm, earthquake, volcanic eruption,

2 Richardson, D. M., P. Pysek, M. Rejmánek, M. G. Barbour, F. D. Panetta and C. J. West. (2000). Naturalization and invasion of alien plants: concepts and definitions. *Diversity and Distributions* 6: 93 – 107.

3 McNeely, J. A., H. A. Mooney, L. E. Neville, P. Schei, and J. K.Waage (eds.) (2001). *A Global Strategy on Invasive Alien Species*. IUCN Gland, Switzerland, and Cambridge, UK. x + 50 pp.

fire, climate) or management regime, but are enhanced or accelerated by the invasion. Examples of invasive species in different taxa (including plants, tunicates, annelids, molluscs, crustaceans, arachnids, insects, fish, amphibians, reptiles, birds and mammals) that have been

The house sparrow (*Passer domesticus*). Photo courtesy of Sevgan Subramanian, *icipe*.

reported over time in Africa are listed in **Annex 2**. The destructive impacts of invasive plant species on biodiversity, food security, health and livelihoods are well recognised (**Annex 3**).

Biological invasions are one of the greatest risks to the rich African biodiversity and the ecosystem services that most Africans' livelihoods depend on. They result from the deliberate and unintended movement of species from their native range to new ranges where they can have adverse impacts on economies and biodiversity. These threats are likely to be exacerbated by climate change as environments change. Many species in the African continent have become extinct or are at risk from biological invasions. Understanding the magnitude of this problem and the processes involved is crucial for managing invasive species in Africa. There is an urgent need therefore to develop a concerted strategy for managing invasive species in Africa.

1.2 Process of Developing the Strategy for Managing Invasive Species in Africa

The process of developing this strategy drew from several undertakings including among others: (a) regional convening events; (b) key stakeholder consultations; (c) literature review; and (d) a questionnaire administered to solicit inputs from a wide array of stakeholders. In February 2018, a stakeholder workshop on "Tackling Invasive species in Africa" was held in Nairobi, co-hosted by the International Centre of Insect Physiology and Ecology (*icipe*), CAB International (CABI) and International Institute of Tropical Agriculture (IITA). This international meeting had over 120 participants from 26 countries (18 in Africa), including the African Union (AU), the Inter-African Phytosanitary Council (AU-IAPSC), the Inter-African Bureau for Animal Resources (AU-IABAR), regional economic communities, development partners, national and international research organisations, private sector, and non-governmental organisations among others.

The meeting discussed multiple aspects of invasive species and recommended that a continental strategy be developed, considering the following five observations.

1. The strategy should support a shift from reactive, ad hoc responses to invasions, towards a proactive, co-ordinated approach.
2. The strategy should be inter-institutional, international, multidisciplinary and multisectoral, involving public-private and policy organisations.
3. Some coordination structures are present but need strengthening.
4. There are challenges in policy implementation and interlinkages amongst regional and national organisations.
5. Communication and data sharing are inadequate, and countries are slow to respond to challenges of tackling invasive species.

Spotted stalk borer. *Chilo partellus* larva. Photo courtesy of R.S. Copeland, *icipe*.

An "Invasive Species Policy Summit", held in association with CABI's Member Country consultation in February 2019 in Gaborone, Botswana, urged countries to develop national invasive species strategies (as agreed by the Conference of the Parties to the Convention on Biological Diversity (CBD), but also emphasised the need for regional collaboration and coordination.

In August – September 2019, Consultative Meetings were held in Addis Ababa, Ethiopia with AU Department of Rural Economy and Agriculture (DREA) and several participants that attended the AU Sanitary and Phytosanitary (SPS) Consultative Workshop. The stakeholders that were engaged in these consultative meetings supported the initiative and unanimously agreed on the scope of the proposed strategy to cover broad taxa including plants, environmental weeds, arthropods, vertebrates – mammals, birds, reptiles, amphibians, fishes, among others. It was also agreed that the strategy should give emphasis on the need to engage across the different sectors and sub-sectors but exclude human disease-causing invaders since these are already addressed within the AU frameworks under Social Affairs Department (such as the Framework for African Public Health Emergency Fund). Nonetheless, the meeting also recognised the fact that alien organisms with potential to disrupt ecosystems also double as pathogens with potential to cause pandemic diseases. For example, the zika virus caused by tiger mosquito (*Aedes albopictus*) and others (such as Ebola virus disease, Marburg, among others) which are suspected to be spread by alien organisms. Furthermore, the consultative meetings generated a list of several stakeholder categories that should be consulted in the process of developing the strategy. The purpose of these stakeholder consultative meetings was to ensure inclusivity and therefore congruence of ideas on the need, objectives and key actions that should be included in the strategy.

In December 2019, a two-day consultative meeting was convened by AU-IAPSC and it engaged stakeholders drawn from several African countries in Douala, Cameroon. The meeting received the draft strategy and made suggestions for improvement. In addition to deliberations on the draft strategy for managing invasive species in Africa, the stakeholder meeting in Douala also focused on and engaged in extensive discussions regarding emergency continental funding mechanisms to support the fight against biological invasions. The meeting drew lessons from the most recent invasion of the fall armyworm (FAW).

The literature review was conducted in order to ensure that the strategy is developed within the context and magnitude of the challenge of invasive species in Africa. Lastly, the questionnaire was used to secure a wider reach to various stakeholders as well as to corroborate plus triangulate inputs from the literature reviews and consultative meetings.

Spiraling whitefly, *Aleurodicus dispersus*. Photo courtesy of G. Goergen, IITA.

2.0 Rationale for developing the strategy for managing invasive species in Africa

2.1 Current knowledge and existing frameworks for managing invasive species

The spread of invasive species, mainly arising from increasing trade, travel and transportation of goods and services across borders, is now recognized as one of the greatest threats to the ecological and well-being of the planet. It is creating complex and far-reaching challenges that threaten both the natural biological riches of the earth and the wellbeing of our people. These species are causing enormous damage to biodiversity and the valuable natural agricultural systems upon which we depend. Direct and indirect health effects are increasingly serious and the damage to native biodiversity is often irreversible. The effects may be exacerbated by global climate change and chemical and physical disturbance to species and their habitats. Invasive species are found in nearly all major taxonomic groups of organisms (including viruses, algae, mosses, fungi, ferns, higher plants, invertebrates, fish, amphibians, reptiles, birds and mammals) and for all groups recorded in Africa.

Globally, the challenge of invasive species is recognized to require international cooperation supplemented by national governments, private sector, development partners and community development organizations at national and local level. A summary of some of the key global, continental and national level frameworks outside Africa that have provisions on management of invasive species is presented in **Annex 4**, **Annex 5** and **Annex 6**.

At the global level, there are several key frameworks developed for invasive species management. For example, the Sustainable Development Goals (SDGs), Aichi Biodiversity targets under the Convention on Biological Diversity (CBD), and the Global Strategy on Invasive Species, among others.

The response to comply to these global frameworks has yielded several continental and national frameworks especially outside Africa (Annexes 4 and 5). In the case of Africa, examples of conventions, guidelines and declarations at continental level that in part address (and/or expected to address) aspects of management of invasive species include among others, the following: (a) AU – IAPSC Strategy 2014 – 2023; (b) AU –IBAR Strategic Plan 2018 – 2023; (c) Policy Framework and Reform Strategy for Fisheries and Aquaculture in Africa (2014); (d) The African Convention on Conservation of Nature and Natural Resources; and (e) the African Strategy on Combating Illegal Exploitation and Illegal Trade in Fauna and Flora in Africa. A summary of these frameworks and regional workshops and their respective key objectives is presented in Table 1. These frameworks, strategies and/or guidelines are limited in scope and are not adequate for purposes of facilitating design and implementation of comprehensive continental-wide interventions for managing invasive species in Africa.

Water hyacinth, *Eichhornia crassipes*. Photo courtesy of Sevgan Subramanian, *icipe*.

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Table 1. Examples of sub-regional and continental-level frameworks and regional workshops addressing and/or strategizing on management of invasive alien species or invasive species.

No.	Title	Key objective(s) with refence to invasive species	Document type
1.	AU – IAPSC Strategy 2014 – 2023	• Robust plant health system and reduced pest risks contribute to better livelihoods, enhanced trade and biodiversity preservation in Africa • The strategy focuses on implementing phytosanitary measures and adherering to interrnationally agreed standards to prevent spread of invasive species and incursion of new plant pest species	Continental-wide strategy
2.	AU –IBAR Strategic Plan 2018 – 2023	• To support and coordinate the sustainable development and utilization of animal resources	Continental-wide strategy
3.	Policy Framework and Reform Strategy for Fisheries and Aquaculture in Africa (2014)	• To facilitate transformation of Africa's fisheries and aquaculture for food, livelihoods and wealth	Continental-wide Policy framework strategy
4.	The African Convention on Conservation of Nature and Natural Resources	• To enhance environmental protection, foster the conservation and sustainable use of natural resources and to harmonize and coordinate policies in these fields with a view to achieving ecologically rational, economically sound and socially acceptable development policies and programs	Continental Convention
5.	The African Strategy on Combating Illegal Exploitation and Illegal Trade in Fauna and Flora in Africa	• To prevent and reduce with the view of eliminating the illegal exploitation and illegal trade in fauna and flora in Africa	Continental-wide strategy
6.	Prevention and Management of Invasive Alien Species: Forging Cooperation throughout West Africa. Proceedings of a Regional Workshop 9 - 11 March 2004, Accra, Ghana	• Raise awareness of the economic and environmental problems caused by invasive species • Promote linkages and cooperation between the different sectors and stakeholders • Foster regional cooperation between the countries of West Africa • Develop an outline of regional strategy for addressing invasive species	Proceedings of a regional workshop
7.	Prevention and Management of Invasive Alien Species: Proceedings of a Workshop on Forging Cooperation throughout Southern Africa	• Prevention and management of invasive alien species: Forging cooperation throughout Southern Africa	Literature/ proceedings
8.	Invasive species: The hidden threat to sustainable development	• A timely reminder of the impact of invasive species; how this growing, global problem is undermining our ability to achieve the SDGs, and highlights the need for all countries to make much faster progress in implementing vital recommendations and achieving targets on invasive species	Policy and media briefing
9.	Developing a regional strategy to address the outbreak of banana *Xanthomonas* wilt (BXW) in East and Central Africa	• This regional strategy for BXW aims to: (i) help mobilize and equip communities to prepare for potential outbreaks in advance of the disease; (ii) respond to the epidemic at the advancing disease front; and (iii) sustain production within the affected areas and provide a coordinated response	Proceedings of Workshop packaged as a strategy
10	East African Armyworm management strategy and implementation plan	• To support countries in the sub-region to strengthen the capacity of smallholder farmers to contain and manage the FAW effectively to minimize its impact on food security and livelihoods of farming households	Sub-regional strategy for a specific invasive species
11	Tomato leaf miner (*Tuta absoluta*): Impacts and coping strategies for Africa	• To provide recommendations to various stakeholders in support of effective management and control of *Tuta absoluta*	Evidence note

Most African countries have ratified several global and continental conventions such as International Plant Protection Convention (IPPC), CBD (Convention on Biological Diversity), SPS (Agreement on the Application of Sanitary and Phytosanitary measures) and ISPM (International Standards for Phytosanitary Measures) that address some specific aspects of invasive species management. To operationalize implementation at national level, a few African countries have enacted frameworks (policies and guidelines) on invasive species management while others have incorporated some elements in their National Biodiversity Strategies and Action Plans (NBSAP). Nonetheless, only a few countries have developed dedicated explicit national policy frameworks to guide actions for managing invasive species. For most countries, and also at the continental level, the response to comply with the ratified international agreements has not materialised and the available instruments are non-binding and besides, they only deal with certain aspects of the problem of invasive species (Table 2).

Table 2. Current response of African governments to global strategies on managing invasive alien species (IAS) or invasive species (IS)

No	Country	Title	Key Focus/Objective	Document Type
1.	Mauritius	The national invasive alien species strategy for the republic of Mauritius 2008-2017 Mauritius Biodiversity Strategy and Action Plan (NBSAP) 2017 – 2025	To establish a comprehensive and coordinated approach to addressing IAS issues and in response to international agreements, notably the Convention on Biological Diversity (CBD). Strategic objectives: 1) Establish a representative and viable protected area Network (PAN), 2) Manage Key Components of Biodiversity, 3) Enable Sustainable Use of Biodiversity, 4) Maintain Ecosystem Services and 5) Manage Biotechnology and its Products.	Management strategy Management and conservation strategy
2.	Ghana	Invasive alien species policy	• Provide measures to prevent, control and manage introductions, establishment and spread of IAS in Ghana. • Minimize economic, ecological and human health impacts of IAS. • Harmonize and coordinate institutional actions aimed at addressing IAS related issues in Ghana. • Ensure effective national regional and international collaboration on IAS.	Policy
3.	Mozambique	Country strategy and programme evaluation	To increase the production and productivity of agriculture and fisheries, working with economically active poor and facilitating their integration into profitable and accessible markets, as well as helping producers to access financing.	Management strategy
4.	South Africa	The status of biological invasions and their management in South Africa	To inform the development and ongoing adaptation of appropriate policies and control measures, both to reduce the negative impacts of invasive species on ecosystems, the economy, and people, and to retain any benefits of invasive species where possible and desirable.	Management strategy
5.	Uganda	Bioinvasion and Global Environmental Governance: The Transnational Policy Network on Invasive Alien Species	Summary of Uganda's action on IAS.	Action briefing[4]

4 Several countries in Africa do not have explicit policies and regulatory frameworks for managing invasive species. But they have action briefings.

With the increasing challenge of invasive species and the impacts thereof, the need for more effective frameworks at national, sub-regional and continental level that address all aspects of the invasive species challenge has become apparent.

2.2 Progress Towards Managing Invasive Species

In keeping with the policy frameworks established at global, continental and national levels, the use of biological control as compared to other mechanisms such as mechanical and chemical use, has shown significant promise. Specific cases with evidence towards progress in Africa and elsewhere are presented below.

The cost of a biocontrol programme – a one-off investment – is also much lower than that of programmes based on other approaches, which in addition may call for recurrent expenditure. In integrated control programmes employing a combination of different approaches, biocontrol may significantly reduce the costs of the associated manual, mechanical and chemical components of control.

However, implementation of biological control programmes in Africa and other developing nations are often hampered by the lack of a framework for the importation of natural antagonist. Countries of origin of invasive species are not always willing to share natural antagonist taking advantage of access and benefit sharing procedures (Cook et al., 20095; 20106). This needs to be addressed urgently at the global level.

Two examples with evidence towards progress in Africa and elsewhere are presented below.

***Lantana camara*:** A member of the verbena family (Verbenaceae), lantana (as commonly known as wild-sage, big-sage, white-sage or tickberry) has spread across wide portions of Africa. Although it is a native to Latin America, it is now widely spread as a notorious weed across different continents. Cost-benefit analyses of use of biocontrol in both South Africa and Australia showed consistently high returns on investment. In South Africa, a benefit–cost ratio of 35:1 has been achieved on biocontrol programmes using a range of introduced organisms, including leaf-mining beetles (such as *Uroplata girardi*), sap-sucking bugs (notably the Tingid, *Teleonemia scrupulosa*), and leaf, flower and seed-feeding species of moths and flies. The benefits accrued include restoration of agricultural or grazing land productivity and ecosystem health, as well as savings made from costs of overall control of Lantana. In Australia, the average national benefit–cost ratio for all biologically controlled noxious weed infestations currently stands at about 24:1. If biocontrol programmes in Australia continue to be expanded at the present rate, an annual net return from these biocontrol programmes could be more than US$100 million within the next 15 to 20 years. Roughly three-quarters of this return is expected to be reflected in agriculture-related gains. In Africa, similar biological control programmes should be applicable for other invasive weeds such as water hyacinth, witch weed, and others.

Lantana or Shrub verbena, *Lantana camara*. Photo courtesy of Paul Nampala, Makerere University, Uganda.

5 *Cock, M. J. W., J. C. van Lenteren, J. Brodeur, B.I.P. Barratt, F. Bigler, K. Bolckmans, F. L. Cônsoli, F. Haas, P. G. Mason and J. R. P. Parra, 2009. The use and exchange of biological control agents for food and agriculture. Background Study Paper No. 47. Commission on Genetic Resources for Food and Agriculture. FAO, Rome, 88 pp.*

6 *Cock, M. J. W., J. C. van Lenteren, J.Brodeur, B.I.P. Barratt, F. Bigler, K. Bolckmans, F. L. Cônsoli, F. Haas, P. G. Mason and J. R. P. Parra, Do new Access and Benefit Sharing procedures under the Convention on Biological Diversity threaten the future of biological control? BioControl 55, 199-218.*

Cassava mealybug (*Phenacoccus manihoti)* is a scale insect species, which originated from south America and was accidentally introduced in Africa in early 1970's. Within 15 years of its discovery, it had invaded most of West and Central Africa and was spreading to the East. By the 1980s the mealybug was a major pest. IITA and partners found a parasitic wasp in South America and they reared and released it in Africa. Conservatively estimated, the benefit-cost ratio for this programme on biological control is 149 to 1. This means that for every one US$ that is spent on the biological control of cassava mealybug, benefits amount to US$149. This success indicates that biological control can play an important role in pest management. The nominal cost of all biological control activities imlemented in 27 African countries starting from 1979 to 2010 were estimated at over US$34.2 million.

Cassava mealybug, *Phenacoccus manihoti*. Photo courtesy of G. Goergen, IITA.

The desired state with regard to invasive species invasions is to prevent and exclude their entry across borders. Unfortunately for Africa, it is estimated that over 250 new alien species of various taxa were introduced in the 20th century and have successfully established. In addition to strengthening the frontline to secure prevention and exclusion, Africa requires a proactive strategy with components of preparedness, early detection, control and management, and restoration and rehabilitation. This is very critical and urgent, especially considering that the alien species have already established and their associated impacts continue to gradually manifest.

2.3 Impacts and Implications of Invasive Species in Africa

Since biodiversity underpins most ecosystem services, it can be reasonably assumed that any specific effects on biodiversity and ecological processes will impact ecosystem services. In South Africa, economic losses associated with invasive species are estimated at US$14 million yr^{-1} for recreation and tourism, US$1,400 million in water resources and about $52 ha^{-1} in lost pollination services (Pejchar and Mooney, 2009)[7]. Impacts of invasive species on ecosystem services and associated economic losses could have serious implications in a continent like Africa, where most of the population depends on ecosystem services for their livelihood. Indeed, invasive species pose one of the biggest threats to human livelihoods and lack of such critical impact assessments to support policy decisions is a major gap that should be addressed.

Efforts have been made elsewhere to quantify economic losses attributed to invasive species. A brief description on the extent of the economic, social, and environmental impact of invasive species is presented below.

2.3.1 Economic impacts

Agriculture, forestry and fishing are of huge importance to the economies of developing countries. Invasive species affect the productivity of these systems, and limit the ability of producers to access export markets. This hinders sustainable economic growth and development. Estimates from 12 African countries suggest an annual loss of 4.1 to a massive 17.7 million tons of maize due to the invasion of Fall armyworm (Rwomushana et al., 2018)[8]. Estimates of economic impacts of five major invasive species (*Chilo partellus*, Maize Lethal Necrosis, *Parthenium hysterophorus*, *Liriomyza* spp. and *Tuta absoluta*) on production from mixed maize cropping systems of smallholders in six countries (Ethiopia, Kenya, Malawi, Rwanda, Tanzania, Uganda) indicated combined current annual losses of US$900-1,100 million with future annual losses (next 5-10 years) to be US$1,000-1,200 million (Pratt et al., 2017)[9]. The extent of economic losses attributed to different invasive species is listed in Table 3.

7 Pejchar, L. and H. Mooney. (2009). Invasive species, ecosystem services and human well-being. *Trends in Ecology & Evolution* 24: 497-504. DOI: 10.1016/j.tree.2009.03.016

8 Rwomushana, I., M. Bateman, T. Beale, P. Beseh, K. Cameron, M. Chiluba, V. Klottey, T. Davis, R. Day, R. Early, J. Godwin, P. Gonzalez-Moreno, M. Kisiime, M. Kenis, F. Makale, I. Mugambi, S. Murphy, W. Nunda, N. Phiri, C. Pratt and J. Tambo. (2018). Fall armyworm: impacts and implications for Africa. Evidence note update. CABI, Wallingford, UK, pp.51. https://www.invasive-species.org/wp-content/uploads/sites/2/2019/02/FAW-Evidence-Note-October-2018.pdf

9 Pratt, C. F., K. L. Constantine and S. T. Murphy. (2017). Economic impacts of invasive alien species on African smallholder livelihoods. *Global Food Security* 14: 31-37.

The economic impacts of invasive species include:

- Value and quality of land degraded;
- Lower crop productivity;
- High cost of controlling pests, weeds and diseases;
- Routes to domestic and global markets blocked; and
- Livestock forced into marginal, sub-optimal grazing lands.

Table 3. Economic losses attributed to invasive species

Species	Impacted economic activity and locality	Annual cost (estimated), US$ million	Source
Lantana (*Lantana camara*)	Crop production and grazing pasture for livestock Pasture production in Australia	924 46.2	Possingham (2006)[10] Swarbrick et al. (1998)[11]
Water hyacinth, (*Echharria crassipes*)	Fisheries and other activities (including htdroschemes), in seven African countries Including impacts on alien fish species such as the Nile perch	20 – 50 71.4	Boy and Witt (2013)[12] Kasulo (2000)[13]
Pines (*Pinus*), Hakea, Australian Wattles (*Accacia* spp)	Control costs of restoring natural fynbos ecosystems in Cape Floral region of South Africa	160	Turpie and Heydenrych (2000)[14]
Six species of noxious weeds	Control costs in agro-ecosystems in Australia	105	Watkinson et al. (2000)[15]
Parthenium weed (*P. hysterrophorus*)	Stock reduction on beef ranches in central Queensland, Australia	5 – 17	Panetta and Lawes (2005)[16]
Varroa Mite	Economic cost of beeking in New Zealand	267 - 602	Wittenberg et al. (2001)[17]
Chilo partellus, Maize Lethal Necrosis, *Parthenium hysterophorus*, *Liriomyza* spp. and *Tuta absoluta*	Combined impact on production from mixed maize cropping systems of smallholders in six countries (Ethiopia, Kenya, Malawi, Rwanda, Tanzania, Uganda)	900 - 1,100	Pratt et al. (2017)
Spodoptera frugiperda	Loss to maize in different parts of Africa	3,000	Rwomushana et al. (2018)
More than 50,000 non-indigenous species	Major damage to the environment and related economic losses	137,000	Pimental et al. 2002[18]
Fusarium Oxysporum F. sp. Cubense TR4	Severe decline in productivity globally and in Mozambique, Africa	2,300	FAO, 201719

2.3.2 Social impacts

Invasive species are a major threat to the livelihoods of the people who live in the areas they colonize. Through disrupting ecosystems, invasive plants, insects and diseases impair access to many of the human needs to sustain a good quality of life – including food and shelter, health, security and social interaction.

10 Possingham, H. P. (2006) Optimal eradication: when to stop looking for an invasive plant. *Ecology Letters* 9: 759–766.
11 Swarbrick, J.T., B. W. Wilson and M. A. Hannan-Jones. (1998). *Lantana camara* L. In: F. D. Panetta, R. H. Groves and R. C. H. Shepherd. (eds.). *The Biology of Australian Weeds*, Vol. 2. R.G. and F.J. Richardson, Melbourne.
12 Boy, G. and A. Witt. (2013). *Invasive Alien Plants and their Management in Africa*. CABI, Nairobi, Kenya.
13 Kasulo, V. (2000). The impact of invasive species in African lakes. In: C. Perrings, M. Williamson and S. Dalmazzone. (eds.). *The Economics of Biological Invasions*. Elgar, Cheltenham.
14 Turpie, J. and B. Heydenrych. (2000). Economic consequences of alien infestation of the Cape Floral Kingdom's Fynbos vegetation. In: C. Perrings, M. Williamson and S. Dalmazzone. (eds). *The Economics of Biological Invasions.* Edward Elgar, Cheltenham.
15 Watkinson, A.R., R.P. Freckleton, and P.M. Dowling. (2000). Weed invasion of Australian farming systems: from ecology to economics. In: C. Perrings, M. Williamson and S. Dalmazzone. (eds.). *The Economics of Biological Invasions*. Edward Elgar, Cheltenham.
16 Panetta, F. D. and R. Lawes. (2005). Evaluation of weed eradication programs: the delimitation of extent. Diversity and Distributions 11: 435–442.
17 Wittenberg, R. and M. J. W. Cock. (2001). *Invasive alien species: A toolkit of best prevention and management practices*. Global Invasive Species Programme, CAB International,Wallingford, Oxon, UK.
18 Pimentel, D., L.Lach, R.Zuniga and D. Morrison, (2002). Environmental and economic costs associated with non-indigenous species in the United States. Biological Invasions. CRC, Boca Raton, 285-303.
19 FAO, 2017. The Global Programme on banana Fusarium wilt disease. Accessed from http://www.fao.org/3/a-i7956e.pdf

The social impacts of invasive species include:

- Livelihood options narrowed;
- Food security decreased;
- Recreational and social opportunities limited;
- Risks to human and animal health increased; and
- Social challenges increased.

2.3.3 Environmental impacts

Biodiversity is essential for the functioning of the ecosystems that provide vital resources such as food, water, fuel, building material and traditional medicines for millions of people. Invasive species alter and degrade the environment, and have a negative effect on both native species and the people who live and work within the ecosystem.

The environmental impacts of invasive species include:

- Biodiversity reduced;
- Availability and quality of key natural resources decreased;
- Water shortages increased;
- Frequency of wildfires and flooding increased; and
- Pollution caused by overuse of chemicals to control infestations increased.

Fusarium wilt or Panama disease, *Fusarium oxysporum* f. sp. *cubense* (Tropical Race 4 - TR4). Photo courtesy of G. Mahuku, IITA.

3.0 Strategic Result Areas and Actions Framework (SRAAF) needed for continent-wide implementation of an effective management of invasive species in Africa

3.1 Vision, Goal and Purpose

The vision of the Strategy on Managing invasive species in Africa which is entrenched in African Union and its sanitary and phytosanitary arms such as AU-IAPSC and AU-IBAR, is to effectively contribute to attainment of continental (Agenda 2063) and global (CBD and SDG Targets) aspirations to achieve sustainable development. The increasing challenge of invasive species in Africa is a serious disincentive towards the aspirations enshrined in Agenda 2063 "The Africa we want". The introduction of species to new environments outside of their natural ranges carries significant risks especially since invasive species are major drivers of biodiversity loss. As such, their continuing spread will certainly undermine the ecological, social, and economic well-being of Africa. Interventions towards management of invasive species will constitute a significant contribution to the agenda 2063, which resonates with targets and aspirations of sustainable development goals (SDGs) as well as Aichi Biodiversity Targets with regard to curtailing bottlenecks with potential to impede inclusive growth, sustainable development and optimization of the use of Africa's resources for the benefit of all Africans.

The **goal** of the Strategy on Managing Invasive Species in Africa is to prepare member states at the continental level under the umbrella of the AU mechanisms for ensuring prevention/exclusion, preparedness, early detection, control and management of invasive species; and restoration and rehabilitation from biological invasions.

The main **purpose** of the Strategy is to secure coordinated actions against invasive species in Africa (at the wider continental, sub-regional and national levels). Previous efforts to manage invasive species have largely been reactive and ad hoc. The increasing frequency of invasions in Africa suggests that many countries lack adequate capacity to detect and implement management measures. To effectively address the invasive species menace in SSA, a shift in strategy is needed from a reactive to a more proactive intervention based on the internationally recognized three-stage approach of prevention, early detection, and control. A proactive, effective approach to invasive species in SSA will require:

Stronger sanitary and phytosanitary capacity and systems;

Continent and nationwide surveillance, and integration of invasive species threats into National disaster response units;

Interdisciplinary, cross border research to develop novel solutions; and

Collaborative resource mobilization, as well as crowd-sourcing and citizen science.

The above approach stipulates urgent need for systematic, coordinated, consolidated, proactive and sufficiently financed national, regional and international strategies to mitigate invasive species. A strategy for managing invasive species in SSA is vital and it will ensure coordination and prioritization of all relevant issues, as well as effective and continuous partnerships and dialogue among all stakeholders.

3.2 Scope of the Strategy

Drawing from the stakeholder consensus (in Section 1.2), the scope of this Strategy is to

Tomato leafminer, *Tuta absoluta* larva. Photo courtesy of R.S. Copeland, *icipe*.

Maize lethal necrosis virus infection in maize field. Photo courtesy of Sevgan Subramanian, *icipe*.

address all biological invasions that impact on all sectors of socio-economic development with the exception of Public Health pathogens as these are already adequately addressed in the other AUC frameworks. The existence of explicit frameworks (strategy and funding mechanisms) in part explains the proactive engagements associated with outbreaks of highly endemic invasive pathogens. Drawing lessons from these efforts underpins the need to reinvigorate and sustain Africa's capacity to handle the invasive species challenge. This implies among others the need to secure instruments that are required for vigilance, predictive modelling, forecasting, monitoring/surveillance, data handling, institutional arrangements and governance structures. It is envisioned to have mechanisms and interventions for appropriate prevention and/or exclusion, early detection, control and management; and restoration and rehabilitation to avert the negative impacts from invasive species.

3.3 Overall and Strategic Objectives and Deliverables

The overall objective of the strategy is to effectively guide and coordinate actions at the continental, regional and national levels towards prevention and eradication of all forms of invasive species in Africa.

More specifically, the strategy aims to achieve the following:

1) Identify, strengthen strategies and mitigate the risk of introduction, establishment and dispersal of invasive species. This is a key step in avoiding the introduction of undesired species in a region like Africa. It is mostly done through detailed analysis of risks to prioritise on significant and imminent invasive species risks, controlled and vigilant boarder movements, especially when live materials are moved across borders. These include food, germplasm or specimens with potential to carry priority invasive species risks. Regulation of such movements requires strict measures across these points. It requires intervention of governments to enforce strong sanitary and phytosanitary measures

2) Establish programmes for rapid control/ eradication of invasive species populations, to eliminate or minimize their negative impacts on ecosystems and conservation efforts. The proposed strategy intends to put into place at continental, regional and national levels, rapid control/eradication plans and programmes for invasive species for early mitigation of their negative impacts to ecosystems and livelihoods. The strategy envisions a compilation, highlight, and sharing of information about existing restoration and rehabilitation successes around the continent and world-wide about invasive species. African Member States will support development of protection policies incorporating the best available practices on using native or desired foreign species for restoration and rehabilitation. The strategy intends to improve infrastructure for producing, purchasing, and keeping seed supplies (germplasm) and other native and desirable non-native plant materials on a regional basis.

3) Strengthen public, private sector and civil society engagement to collectively prevent, control and eradicate invasive species. Among the many barriers to achieving the objectives of the Convention on Biological Diversity, and of the other biodiversity-related conventions, the lack of public awareness on the importance of biodiversity ranks as one of the most critical. The lack of public awareness contributes to the relatively low political priority given to biodiversity issues. Active public engagement is crucial to successful management of invasive species. The proposed strategy will help African governments and organisations to engage the public successfully for a greater benefit leading to informed public that support on-going actions to reduce the threat of invasive species, and key stakeholders who are actively engaged in implementation of invasive species solutions.

4) Establish continental, regional and national level emergency funding mechanisms to facilitate rapid action against invasives. Often this is the biggest hurdle for early response. Species invasions are a consequence of human activities and have serious economic impacts. However, the costs of managing invasions are seldom reflected in emergency responses. This strategy is developed with a view that governments shall pool funds and incorporate economic principles to support efforts for addressing the invasive species challenge in Africa.

5) Foster research for development (R4D) efforts in all elements of invasive species management including preparedness, predictive modelling, forecasting, monitoring/surveillance, data handling and governance structure and institutional arrangements. Capacity to manage invasive species in Africa is very limited. The current knowledge on invasive species must be developed with a cross-sectoral and multidisciplinary approach in order to provide tools needed to address this pervasive issue. There is urgent need to improve the understanding of how and why species become established. Furthermore, there is also an urgent need to investigate species that have the potential to become invasive and ecosystems that may be particularly vulnerable to invasion.

6) Effective coordination of invasive species management in Africa strengthened and supported by effective phytosanitary, regulatory system and enabling policies. There is urgent need for systematic, coordinated, consolidated, proactive and sufficiently financed national, regional and intentional strategies to mitigate invasive species in Africa. Thus, a strategy for managing invasive species in Africa is vital, to ensure coordination and prioritisation of all relevant issues, as well as to facilitate effective and continuous partnerships and dialogue among all stakeholders.

The links between the vision, goal and strategic objectives are presented in Figure 2. The six strategic objectives are: (1) Detect, prevent and/ or reduce the risk of introduction, establishment and dispersal of invasive species; (2) Establish rapid control, management and eradication programs for invasive species populations, which minimize or eliminate their negative impacts and favour ecosystem restoration and conservation; (3) Strengthen public engagement and participation as an appropriate and efficient way to achieve a broad public private sector as well as civil society support and participation within their reach in actions to prevent, control and eradicate invasive species; (4) Establish continental, regional and National emergency funding mechanisms for rapid action against invasive species; (5) Facilitate education and research for development to promote effectiveness and efficiency in all elements of invasive species management including preparedness, predictive modelling, forecasting, monitoring/surveillance, data handling and governance structure and institutional arrangements; and (6) Effectively manage and coordinate invasive species challenge in Africa.

The details on strategic objectives, activities/ interventions and the expected results and their measurable indicators to assess progress are presented in the Strategic Result Areas and Action Framework (SRAAF) matrix (Table 4).

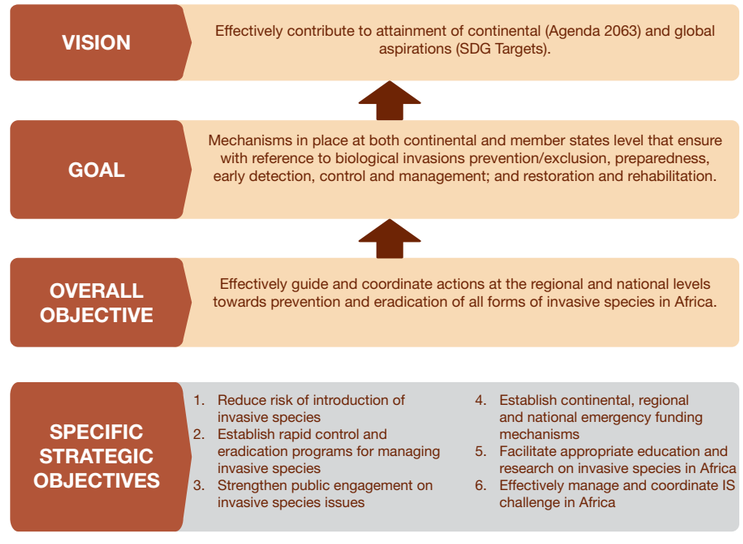

Figure 2. Strategic results chain: Conceptual framework of Strategy for Managing Invasive Species in Africa

Table 4. Strategic Result Areas and Action Framework (SRAAF) matrix

Strategic Objective 1 (SO1): Detect, prevent and/or reduce risk of introduction, establishment and dispersal of invasive species				
Components	**Key Activities**	**Expected Results**	**Measurable Indicators**	**Responsibility**
1.1 Establish an effective legislative and regulatory environment	1.1.1 Facilitate the development and effective implementation of structurally standardised and robust invasive species policies and strategies 1.1.2 Comprehensive assessment of existing policy and legal frameworks relevant to biological invasions in the region (both nationally for member states and as a regional block) 1.1.3 Assess the effectiveness of legal and policy frameworks in the management of biological invasions across the region. 1.1.4 Promote regional and member state action plans which will contribute to the implementation of the National strategies to understand and manage biological invasions	• Legal framework appropriate to regulate the introduction and management of invasive species. • Transparency within functions, authority and responsibilities in the matter, within each sector, for the coordinated attention of the problems caused by invasive species. • Gap analyses on the effectiveness of legal and policy frameworks in the region	• Legal framework appropriate to regulate the introduction and management of invasive species. • Gap analyses on the effectiveness of legal and policy frameworks in the region • Regional quarantine and biosecurity guidelines • Regional high-risk invaders list • Pathway risk management protocols – sea-land-air pathways strategies • Standard regional (and country specific if possible) species specific management plans • Priority ecosystems management and/or rehabilitation and restoration from impacts of invasions plans	• Member states • RECs
1.2 Prevent the introduction of species that pose a substantial invasion risk	1.2.1 Promote collaboration between border agencies to establish joint inter-governmental biosecurity inspectorate at borders to detect high risk invasive species. 1.2.2 Build institutional and individual capacity and policy frameworks for effective application of risk protocols to assess and manage all risks 1.2.3 Identify high-risk pathways of introduction and develop a strategy for each species 1.2.4 Conduct sub-regional pest risk analyses and and strengthen information sharing mechanisms amongst member states	• Regional Biosecurity Strategy • Regional high-risk invaders list • Pathway risk management protocols – sea-land-air pathways strategies		Member states
1.3 Reduce the rate of spread of invasions and reduce the impacts of existing invasions	1.3.1 Develop regional guidelines for high risk listed invasive species management plans 1.3.2 Develop management plans for priority ecosystems	• Standard regional (and country specific if possible) species specific management plans • Management plans for priority ecosytems		• Members States
Strategic objective 2 (SO2): Establish rapid control, management and eradication programs for invasive species populations, which minimize or eliminate their negative impacts and favour ecosystem restoration and conservation				
Components	**Key Activities**	**Expected Results**	**Measurable Indicators**	**Responsibility**
2.1 Promote co-ordination and collaboration across all affected sectors and regions/ countries	2.1.1 Create a regional knowledge sharing platform on biological invasions 2.1.2 Identify priorities for the control or eradication of invasive species 2.1.3 Share lessons learned learnt from other regions	• Allocation of resources focused on country priorities regarding invasive species • Regional working groups established around identified priorities • Knowledge hub for key information and data on invasives in the sub-region	• Sub-Regional Data and information portal on biological invasions linked to the Global platforms such as Global invasive species database (http://www.iucngisd.org/gisd/ and CABIs Invasive Species Compendium) • National EDRR strategies linked to the high level sub-regional strategy	AU-IAPSC and AU-IBAR
2.2 Eradicate introduced species where possible and desirable	2.2.1 Develop sub-regional Early Detection and Rapid Response (EDRR) strategy for dealing with newly-detected invasions 2.2.2 Develop and implement Species Specific Management and Eradication plans (SSMEPs) for target species 2.2.3 Undertake specific targeted surveys, involving taxonomic experts for each taxa (e.g. Athropods, Grasses, Cactaceae, Autralian trees, etc)	• Sub-Regional Early Detection and Rapid Response (EDRR) strategy • National EDRR strategies linked to the high level sub-regional strategy • SSMEPs developed and implemented • Taxon specific sub regional working groups for surveys and knowledge sharing	• SSMEPs developed and implemented • Taxon specific sub regional working groups for surveys and knowledge sharing • Allocation of resources focused on continental, regional and national priorities regarding invasive species • Knowledge hub for key information and data on invasive created	• RECs • Development partners (IITA, CABI and *icipe*)

			• Co-ordination and collaboration across all sectors and regions/countries on aspects of management of invasive species promoted • Introduced Invasive species effectively eradicated	
Strategic Objective 3 (SO3): Strengthen public engagement and participation as an appropriate and efficient way to achieve a broad public private sector as well as civil society support and participation within their reach in actions to prevent, control and eradicate invasive species				
Components	**Key Activities**	**Expected Results**	**Measurable Indicators**	**Responsibility**
3.1 Manage and provide access to data and information	3.1.1 Undertake a survey of potential users (user-needs analysis) to determine information needs 3.1.2 Develop minimum standards for sub-regional data collection and storage 3.1.3 Assess the level of invasives data and information availability at member states 3.1.4 Establish a single-data portal that can collate and link to all data on biological invasions, with appropriate data sharing agreements in place 3.1.5 Design and implement a web-based interface to enable member states public access to information	• Sub-Regional Data and information portal on biological invasions • Minimum standards for sub-regional data collection and storage • Web-based interface to enable member states public access to information • Assessment of the level of data and information available at each member state in the sub-region • A functional information database of linked regional and continental databases on invasive species.	• Sub-Regional Data and information portal on biological invasions linked to the Global Invasive Alien Species Information System (GIASIS) • Minimum standards for sub-regional data collection and storage • Web-based interface to enable member states public access to information including that generated by the Invasive Species Specialist Group (ISSG) • Assessment of the level of data and information available at each member state in member states • Accredited short course on Biological invasions in the member states • Enhanced research capacity at institutions mandated to work on invasive species management • Number of post-graduate students registered/completed at institutions in member states • Research papers published in peer reviewed journals from member states to support decision making	
3.2 Develop adequate management and research capacity	3.2.1 Develop an accredited short course on biological invasions for policy makers, managers and planners in member states 3.2.2 Put aside funds to develop research capacity on invasives for students and researchers in the sub-regional institutions and entities 3.2.3 Develop and enhance skills and capacity in critical but poorly-resourced focus areas (e.g. risk analyses, taxonomy of under-studied but problem taxa groups)	• Accredited short course on Biological invasions in member states • Enhanced research capacity at institutions in member states • Number of post-graduate students registered/completed at institutions in member states • Research papers published in peer reviewed journals from member states to support decision making • Sub-regional capacity and skills development 5 – 10 year strategy		• Research agencies • Higer education institutions • Development partners

3.3 Raise awareness and advocacy for management of biological invasions	3.3.1 Establish a sub-regional invasive species awareness and advocacy strategy 3.3.2 Identify key stakeholder groupings, and disseminate information as needed 3.3.3 Institute a National invasive species day/week/month, assigned to a national public – private joint venture organization 3.3.4 Develop communications and marketing material	• Sub-regional invasive species maketing and advocacy strategy • National marketing and advocacy strategies linked to sub-regional agenda and development priorities	• Increased public engagement on invasive species issues • Enhanced stakeholder participation in invasive species management activities • Number of institutions and agencies including civil society groups dedicated on invasive species prevention, exclusion and management	• RECs • Media and communications agencies in the member states
3.4 Ensure effective monitoring and evaluation (M&E) of efforts and interventions	3.4.1 Develop indicators to monitor effectiveness of interventions in managing invasive species 3.4.2 Develop an M&E system to evaluate the programme at the sub-region and at national levels	• Reference mannual indicators to monitor and evaluate indicators for effectiveness • M&E system at sub-regional and national levels	• Annual continental outlook featuring progress on management of invasive species • Increase in the number of knowledge and communication products published on invasive species impacts in Africa	• RECs • Member sates

Strategic Objective 4 (SO4): Establish continental, regional and National emergency funding mechanisms for rapid action against invasive species

Components	Key Activities	Expected Results	Measurable Indicators	Responsibility
4.1 Establish mechanism for efficient and effective mobilisation of resources (both financial and human capital) for managing invasive species	4.1.1 Establish easily accessible funds for emergency actions at national, sub-regional and continental levels 4.1.2 Regulatory support for funding mechanisms towards management of invasive species 4.1.3 Design and establish a rapid response mechanism to detect and respond to potentially invasive species as soon as they appear	• A proactive and coordinated approach for emergency response on all aspects of invasive species • Enhanced member states response, partners and private sector in support for management of invasive species	• Functional continetal emergency fund established • Number of countries subscribing to continental emergency fund • Guidelines enacted for deployment and management of the continental emergency fund	
4.2 Direct existing relevant financial resources towards a focus on invasive species in Africa	4.2.1 Encourage intergovernmental cooperation in invasive species programs that they fund 4.2.1 Develop harmonisation and linkages among development partners and international agencies to pool resources on invasive species programs	• Effectiveness and efficient deployment of available resources towards management of invasive species • Functional and coordinated development partners support on invasive species agenda	• Intergovernmental working group and development partner forums focused on leveraging resources for invasive species management programs	• RECs • Member states

Strategic objective 5 (SO5): Facilitate education and research for development to promote effectiveness and efficiency in all elements of invasive species management including preparedness, predictive modelling, forecasting, monitoring/surveillance, data handling and governance structure and institutional arrangements

Components	Key Activities	Expected Results	Measurable Indicators	Responsibility
5.1 Build human resource capacity and strengthen infrastructure on invasive species at national and regional level	5.1.1 Establish sub-regional reference laboratories for invasive species research 5.1.2 Establish thematic research teams on key aspects of invasive species 5.1.3 Promote exchange and collaboration in formulation of invasive species research approaches/methodologies	• Proactive research teams generating relevant knowledge on invasive species in Africa including preparedness, predictive modelling, forecasting, monitoring/ surveillance, data handling, rapid response and management • Increased level and quality of community engagement	• Number of thematic research teams established and sustaining research and key invasive species engagements • At least six functional refence laboratories for invasive species research • Number of interregional research initiatives and collaborations	• RECs • Member states

5.2 Strengthen research and training institutions on aspects of invasive species	5.2.1 Undertake critical and relevant research and its dissemination 5.2.2 Develop and implement educational and research programs to build capacity for field staff, managers, specialists and policy makers 5.2.3 Build capacity and empower communities on key aspects of invasive species e.g. preparedness, prevention, early detection and control 5.2.4 Develop national-level institutions that bring together multidisciplinary research for development teams (including biodiversity, agricultural and environmental specialists)	• University curricula • Student fellowships on invasive species • Existing staff retooled on aspects of invasive species prevention, exclusion and management skills • Invasive species specialist positions in natural resource agencies established	• Modules and calicula dedicated to training and retooling on different aspects of invasive species • Number of student fellowships offered and completed • Number of staff retooled • Number of institutions with units and staff establishments dedicated on aspects of invasive species • Compiled databases of potential and established invasive species	• Research agencies • Higher education institutions • Development partners • FARA
5.3 Develop a system of environmental risk assessments and analysis	5.3.1 Build capacity to identify, record, and monitor invasions and provide databases of potential and established invasive species 5.3.2 Develop foresight, prediction, early detection, assessment, prevention and control capacity	• Evidence-based data/information for informed decision making • Improved techniques to eradicate and control invasive species • Better methods for excluding or removing alien species from traded goods, packaging material, personal luggage, aircrafts, ships and other methods of transport • Methods for ecosystem restoration and sustainability developed and promoted		• Research agencies • Higher education instutions • Development partners

Strategic objective 6 (SO6): Effectively manage and coordinate invasive species challenge in Africa

Components	Key Activities	Expected Results	Measurable Indicators	Responsibility
6.1 Identify, maintain/ develop human and institutional capacity to manage the programme of work on the strategy	6.1.1 Establish a network of stakeholders to support AU DREA to manage and coordinate this programme of work 6.1.2 Appoint personnel to manage operations of the strategy	• Entity with experience, reputation, capacity and funder's approval to coordinate the programme – Technical Support Unit and Coordinating Body • Appointed staff representative of the sub-regional diversity	• Functional management system and human resource instituted • Dedicated uint at continental level established with mandate to coordinate invasive species activities on prevention, eradication and management	• AU-DREA • Development partners
6.2 Build and strengthen cooperation between institutions and development partners towards a continental platform to mitigate the threat of invasive species	6.2.1 Promote interdepartmental coordination on invasive species that can quickly identify and give authority to a lead agency/agencies 6.2.2 Build basic border control and quarantine capacity	• Cooperation within each country and among sectors whose activities have a great potential to introduce invasive species (including water supply, tourism, health, transport, aquaculture, agriculture, forestry, trade and military) enhanced	• Protocols for effective border control and quarantine management enacted and disseminated to members states	

4.0 Implementation plan of SRAAF

4.1 Institutional Engagements for Effective Implementation

The strategy for managing invasive species will be implemented at various levels, with key institutions having specific roles that should be complementary to each other.

- The African Union Assembly is called upon to provide political support, direct the common positions of the continent in engaging the rest of the world on aspects of invasive species management as proposed in this strategy.
- The AU Commission (AUC) will provide not only a coordination mechanism for the implementation of the strategy at continental level, but also provide strategic guidance, facilitate domestication and implementation of the strategy, and seek support from partners. In addition, the AUC shall ensure coherence in the implementation of the strategy and that the strategy is included in the operationalisation of the Agenda 2063 – "The Africa We Want"; as well as Projects and Programs towards achievement of global targets on invasive species including but not limited to those provided in the SDGs, Aichi Biodiversity Targets and the Global invasive species strategy.
    - The AUC will through the DREA engage different institutions to support (as per respective functions and mandates) the coordination and implementation of this strategy. To ensure efficient coordination, on the crosscutting issues of invasive species
- The African Ministerial Conference on the Environment (AMCEN) and the Ministers of Science & Technology Committee (STC) shall promote and provide guidance in implementation of the strategy.
- The Member States will use this strategy as a minimum standard to draw elements that will facilitate the development and implementation of respective national strategies. The Member States will be required to establish national strategies and programmes and implement activities (including building of human and infrastructural capacity) in the continuum of managing invasive species. These include: 1) prevention and exclusion; 2) preparedness; 3) early detection; and 4) control and management, restoration and rehabilitation. In this regard, Governments will be required to develop policies and guidelines to ensure the provision of adequate resources for implementation of respective national strategies. Furthermore, Governments will be required to institute mechanisms for effective public and private sector participation.
    - It is expected that national governments through relevant line ministries and agencies (e.g. Competent Authorities, National Plant Protection Organisations, NPPOs and private sector actors) will serve as the focal implementation units for most of the activities highlighted in the strategy. The member states are signatories to global frameworks and initiatives and are thus obligated to comply to minimum standards and provisions. National Plant Protection Organizations and the AU should serve as an aggregator for Member States engagements on invasive species and relay such information (progress and data) to relevant global institutions such as the CBD secretariat.
- Africa is highly heterogeneous and in terms of invasive species, the sub-regions have their own specificities that may require to be customized and contextualized in their responses. Thus, sub-regions may also develop sub-regional strategies and other framework instruments while taking into consideration and building on the Africa-wide Strategy. The Regional Economic Commissions (RECs) will be required to integrate the strategy into their regional development plans, coordinate, and facilitate the development and implementation of region specific actions and action plans within their regions. The RECs are also expected to facilitate regional resource mobilization to support regional efforts especially concerning challenges on transboundary biological invaders.

Desert locust, *Schistocerca gregaria*. Photo courtesy of Saliou Niassy, *icipe*.

Papaya mealybug, *Paracoccus marginatus*. Photo courtesy of G. Goergen, IITA.

4.2 Planning and Implementation of the Strategy

The strategy shall be operationalized in five-year cycles to allow for opportunity to address emerging issues progressively based on experiences gained during the implementation of the foregoing five-year period into the next. The implementation of identified interventions will be prioritised in a manner that allows for quick results and impacts in the short, medium and long-term. However, this does not imply that those actions that need to commence now at a particular phase of the five-year cycle but have longer term impact should be ignored. Instead, they will be programmed to start at appropriate times.

Once established in the first six months of approval of this strategy, the AU-DREA will engage stakeholders to prioritize and propose areas of intervention for implementation in the first five –year cycle starting January 2021 (Table 5).

Table 5. Implementation plan for the first five years (2021-2025) of the strategy for managing invasive species in Africa (2021-2030)

Strategy for managing invasive species in Africa (2021-2030): Implementation plan for the first five years (2021-2025)											
Components	**Key activities**	**2021**		**2022**		**2023**		**2024**		**2025**	
Strategic Objective 1 (SO1): Detect, prevent and/or reduce risk of introduction, establishment and dispersal of invasive species											
1.1 Establish an effective legislative and regulatory environment	1.1.1 Facilitate the development and effective implementation of structurally standardised and robust invasive species policies and strategies				X	X	X	X			
	1.1.2 Comprehensive assessment of existing policy and legal frameworks relevant to biological invasions in the region (both nationally for member states and as a regional block)			X							
	1.1.3 Assess the effectiveness of legal and policy frameworks in the management of biological invasions across the region				X	X					
	1.1.4 Promote regional and member state action plans which will contribute to the implementation of the National strategies to understand and manage biological invasions				X	X	X	X	X	X	X
1.2 Prevent the introduction of species that pose a substantial invasion risk	1.2.1 Promote collaboration between border agencies to establish joint inter-governmental biosecurity inspectorate at borders to detect high risk invasive species.								X	X	X
	1.2.2 Build institutional and individual capacity and policy frameworks for effective application of risk protocols to assess and manage all risks				X	X					
	1.2.3 Identify high-risk pathways of introduction and develop a strategy for each species					X	X	X	X	X	
	1.2.4 Conduct sub-regional pest risk analyses and and strengthen information sharing mechanisms amongst member states		X	X	X	X	X	X			
1.3 Reduce the rate of spread of invasions and reduce the impacts of existing invasions	1.3.1 Develop regional guidelines for high risk listed invasive species management plans			X	X	X					
	1.3.2 Develop management plans for priority ecosystems						X	X	X	X	X
Strategic objective 2 (SO2): Establish rapid control, management and eradication programs for invasive species populations, which minimize or eliminate their negative impacts and favour ecosystem restoration and conservation											
2.1 Promote co-ordination and collaboration across all affected sectors and regions/countries	2.1.1 Create and maintain a regional knowledge sharing platform on biological invasions			X	X	X	X	X	X	X	X
	2.1.2 Identify priorities for the control or eradication of invasive alien species				X	X	X	X	X	X	X
	2.1.3 Share lessons learned learnt from other regions			X	X	X	X				

Strategy for managing invasive species in Africa (2021-2030): Implementation plan for the first five years (2021-2025)											
Components	**Key activities**	**2021**		**2022**		**2023**		**2024**		**2025**	
2.2 Eradicate introduced species where possible and desirable	2.2.1 Develop sub-regional Early Detection and Rapid Response (EDRR) strategy for dealing with newly-detected invasions					X	X				
	2.2.2 Develop and implement Species Specific Management and Eradication plans (SSMEPs) for target species					X	X	X	X	X	X
	2.2.3 Undertake specific targeted surveys, involving taxonomic experts for each taxa (e.g. Athropods, Grasses, Cactaceae, Autralian trees, etc)					X	X	X	X	X	X
Strategic Objective 3 (SO3): Strengthen public engagement and participation as an appropriate and efficient way to achieve a broad public private sector as well as civil society support and participation within their reach in actions to prevent, control and eradicate invasive species											
3.1 Manage and provide access to data and information	3.1.1 Undertake a survey of potential users (user-needs analysis) to determine information needs			X							
	3.1.2 Develop minimum standards for sub-regional data collection and storage				X						
	3.1.3 Assess the level of invasive species data and information availability at member states					X	X				
	3.1.4 Establish a single-data portal that can collate and link to all data on biological invasions, with appropriate data sharing agreements in place				X	X	X	X	X	X	X
	3.1.5 Design and implement a web-based interface to enable member states public access to information					X	X	X	X	X	X
3.2 Develop adequate management and research capacity	3.2.1 Develop and implement an accredited short course on biological invasions for policy makers, managers and planners in the sub-region				X	X	X	X	X	X	X
	3.2.2 Put aside funds to develop research capacity on invasive species for students and researchers in the sub-regional institutions and entities				X		X		X		X
	3.2.3 Develop and enhance skills and capacity in critical but poorly-resourced focus areas (e.g. risk analyses, taxonomy of under-studied but problem taxa groups)					X	X	X	X	X	X

Strategy for managing invasive species in Africa (2021-2030): Implementation plan for the first five years (2021-2025)

Components	Key activities	2021		2022		2023		2024		2025	
3.3 Raise awareness and advocacy for management of biological invasions	3.3.1 Establish a sub-regional invasive species awareness and advocacy strategy				X						
	3.3.2 Identify key stakeholder groupings, and disseminate information as needed			X	X	X	X	X	X	X	X
	3.3.3 Institute a National Invasive Species day/week/ month, assigned to a national public – private joint venture organization				X	X	X	X	X	X	X
	3.3.4 Develop communications and marketing material		X	X	X	X	X	X	X	X	X
3.4 Ensure effective monitoring and evaluation (M&E) of efforts and interventions	3.4.1 Develop indicators to monitor effectiveness of interventions in managing invasive species				X	X	X				
	3.4.2 Develop an M&E system to evaluate the programme at the sub-region and at national levels			X							
Strategic Objective 4 (SO4): Establish continental, regional and national emergency funding mechanisms for rapid action against invasive species											
4.1 Establish mechanism for efficient and effective mobilisation of resources (both financial and human capital) for managing invasive species	4.1.1 Establish easily accessible funds for emergency actions at national, sub-regional and continental levels			X	X						
	4.1.2 Regulatory support for funding mechanisms towards management of invasive species				X	X	X	X	X	X	X
	4.1.3 Design and establish a rapid response mechanism to detect and respond to potentially invasive species as soon as they appear				X	X	X				
4.2 Direct existing relevant financial resources towards a focus on invasive species in Africa	4.2.1 Encourage intergovernmental cooperation in invasive species programs that they fund			X	X	X					
	4.2.2 Develop harmonisation and linkages among development partners and international agencies to pool resources on invasive species programs					X	X				
Strategic objective 5 (SO5): Facilitate education and research for development to promote effectiveness and efficiency in all elements of invasive species management including preparedness, predictive modelling, forecasting, monitoring/surveillance, data handling and governance structure and institutional arrangements											
5.1 Build human resource capacity and strengthen infrastructure on invasive species at national and regional level	5.1.1 Establish sub-regional reference laboratories for invasive species research								X	X	X
	5.1.2 Establish thematic research teams on key aspects of invasive species				X	X					
	5.1.3 Promote exchange and collaboration in formulation of invasive species research approaches/ methodologies					X	X	X	X	X	X

Strategy for managing invasive species in Africa (2021-2030): Implementation plan for the first five years (2021-2025)

Components	Key activities	2021		2022		2023		2024		2025	
5.2 Strengthen research and training institutions on aspects of IAS	5.2.1 Undertake critical and relevant research and its dissemination				X	X	X	X	X	X	X
	5.2.2 Develop and implement educational and research programs to build capacity for field staff, managers, specialists and policy makers					X	X	X	X	X	X
	5.2.3 Build capacity and empower communities on key aspects of invasive species e.g., preparedness, prevention, early detection and control						X	X	X	X	X
	5.2.4 Develop national-level institutions that bring together multidisciplinary research for development teams (including biodiversity, agricultural and environmentalist specialists)						X	X			
5.3 Develop a system of environmental risk assessments and analysis	5.3.1 Build capacity to identify, record, and monitor invasions and provide databases of potential and established invasive species				X	X	X	X	X	X	X
	5.3.2 Develop foresight, prediction, early detection, assessment, prevention and control capacity				X	X	X	X			
Strategic objective 6 (SO6): Effectively manage and coordinate invasive species challenge in Africa											
6.1 Identify, maintain/ develop human and institutional capacity to manage the programme of work on the strategy	6.1.1 Identify an Entity to manage and coordinate this programme of work	X									
	6.1.2 Appoint personnel to manage operations of the strategy	X	X								
6.2 Build and strengthen cooperation between institutions and development partners towards a continental platform to mitigate the threat of invasive species	6.2.1 Promote interdepartmental coordination on IAS that can quickly identify and give authority to a lead agency/agencies		X	X	X						
	6.2.2 Build basic border control and quarantine capacity			X	X	X	X	X	X	X	X

Red tomato spider mite, *Tetranychus evansi*. Photo courtesy of Sevgan Subramanian, *icipe*.

5.0 Financing and Resource Mobilization to Support Implementation of SRAAF

The African Union, AMCEN, STC and Member States are responsible for mobilizing financial and technical resources required to support the effective implementation of this Strategy. Member States are expected to commit financial resources and work with development partners and other actors to mobilize resources for implementation of the strategy. Since invasive species are in most cases handled as an emergency, Member States are urged to develop a Consolidated Emergency Fund (CEF) to support the efforts on rapid response and deployment of needed actions to prevent and manage invasive species as appropriate.

6.0 Monitoring, Evaluation, Accountability and Learning (MEAL)

A monitoring, evaluation, accountability (reporting) and learning framework will be developed in consultation with countries, RECs and stakeholders for tracking the performance and impact of the specific strategic objectives and actions presented in the strategy. The measurable indicators to be tracked are outlined in Table 4. The MEAL will be developed with a view to ensure achievement of results that contribute effectively towards the attainment of objectives of the Strategy for Managing invasive species in Africa which entails among others: (i) improving institutional and stakeholders' knowledge of the strategy and its impacts; (ii) improving policy and decision making; and (iii) promoting an accountability culture towards results with reference to managing invasive species in Africa.

7.0 Vision of success

Implementation of this strategy is an anticipated significant step in achieving better coordination between and among Member States in addressing the problem of invasive species in Africa. Such coordination will need to be based on the best available evidence on invasions and management responses. Thus, the end in view of this strategy by 2030 entails the following:

- A coordinated AU-DREA invasive species management effort at continent level working closely with an effective system at national level to prevent the impact of invasive species; and appropriate controls exist at border posts to prevent the accidental introduction of native species that might pose threats elsewhere;
- Each Member State of the AU has an effective technical communication network, an accessible knowledge database, a planned system for review of proposed introductions and an informed public on all aspects of invasive species;
- Each Member State of AU has an effective system of public education, research and information dissemination on invasive species;
- Effective research programs have been established at national, sub-regional and continental levels including knowledge on the taxonomy of each nation's biota, research on invasive pathways and management measures, and that each Member State of the AU has an effective legal basis for addressing the invasive species menace; and
- Each member state prioritizes invasive species as a threat to their economy and environment and allocates sufficient funding for invasive species management.

Ultimately, implementation of this strategy should support Africa's effort to not only achieve sustainable functioning of biodiversity and ecosystems at continental level but also in the long-term reduce significantly the financial resources that have otherwise been spent through ad hoc and reactive approaches geared towards ineffective prevention, exclusion and management of invasive species.

Western flower thrips, *Frankliniella occidentalis*. Photo courtesy of Sevgan Subramanian, *icipe*.

Strategy for Managing Invasive Species in Africa

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Desert locust, *Schistocerca gregaria* swarm on shrub tree. Photo courtesy of Saliou Niassy, *icipe*.