



Invasive Species

the livelihoods threat

**Progress report on pre-implementation activities
for the CABI invasive species programme in
Africa and Asia, 2014–2016**

30 May 2017

Executive summary

Background

Invasive species are estimated to cost the global economy over US\$1.4 trillion annually and have negative impacts on the livelihoods of vulnerable communities, driving food insecurity and undermining ongoing investments in development. The geographic spread and impact of invasive species is accelerating due to climate change, trade and tourism.

CABI's new invasive species programme

Since 1927, CABI has led or made major contributions to over 50 invasive species management projects across Africa, Asia and the Americas that used biocontrol as a key component of Integrated Pest Management (IPM). During the last round of consultations (2015-2016) with its 48 member countries, CABI received unanimous endorsement of the need for systematic action, with widespread recognition of the threat of invasive species and the value that a comprehensive CABI-led programme would bring. CABI has therefore repositioned its approach to combat the threat and impact of invasive species by building a cross-sectoral coalition of interested stakeholders to operate a three-stage approach to the problem: prevention, early detection and rapid response, and control and restoration. The programme will build on CABI's global experiences in managing invasive species to improve rural livelihoods, food security and trade, as well as protecting agricultural and natural ecosystems.

Progress in 2014–2016

Pre-implementation activities for the invasive species programme were carried out between 2014 and 2016, with successes in three areas:

Building the evidence base on invasive species and their impacts: the impacts of invasive species on the economy and rural livelihoods have been investigated, consultations have taken place with international researchers on the link between invasive species and malaria, and methods for managing invasive species have been investigated. As a result of this work, a number of scientific journal articles and one book chapter have been published.

Raising awareness of the problem of invasive species:

a website on **invasive species** has been created, the invasive species programme has been promoted at international events (eg COP13, EcoSummit), CABI has worked with **SciDev.Net** on an awareness campaign on the problem, and management guides for certain species have been developed and distributed.

Preparing for implementation of the invasive species programme:

consultations have taken place with CABI member countries, distribution maps of invasive species that pose a threat have been developed, and key documents for programme implementation have been drafted (including the programme strategy and theory of change, and technical documents setting out CABI's approach to determine which invasive species can and should be prioritised within a country and region).

Next steps

The next steps will build on this strong foundation to implement the programme. Under the current funding for the programme, planned activities are ongoing – principally in Ghana and Pakistan, but also at an international level – to generate partnerships and policy awareness; build capacity in the areas of prevention, detection and response and control; reach and advise rural households about biological invasions; and develop invasive species information resources and tools.

At the same time, CABI is seeking a US\$50 million investment to implement the invasive species programme globally, with the aim to protect and improve the livelihoods of 50 million poor rural households impacted by the worst invasive species. This money will be spent on four main activities: collecting and sharing of data and knowledge; fostering partnerships at regional, national and local levels; validating management options and building capacity; carrying out community-level activities at scale. Cross-cutting work will cover monitoring and evaluation, and gender empowerment and youth inclusion.

Required funding

The invasive species programme strategy has been endorsed by CABI's 48 member countries and CABI is now ready to implement the programme. The proposed investment of US\$50 million in the programme will help to reverse the invasive species threat and protect 50 million rural families from devastating losses.

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Introduction

Invasive species are estimated to cost the global economy over US\$1.4 trillion. They disproportionately affect communities in poor rural areas, who depend on natural resources and healthy ecosystems for their livelihoods, driving food insecurity and undermining ongoing investments in development, including measures for adapting to climate change. Unfortunately, the geographic spread and impact of invasive species is increasing due to climate change, trade and tourism.

CABI's invasive species programme aims to protect and improve the livelihoods of 50 million poor rural families impacted by invasive species through an environmentally sustainable, regional approach to comprehensive biological invasion management. The ultimate intention is to protect and restore agricultural and natural ecosystems, reduce crop losses, improve health, protect trade and reduce degradation of natural resources and protected areas.

CABI is well-placed to champion systematic change in invasive species management. CABI manages high quality data on issues relating to rural livelihoods and the problems of biological invasions, widely used by the global scientific community, as well as in developing countries. CABI's open-access

Invasive Species Compendium is the only up-to-date encyclopaedic resource that brings together a wide range of different types of science-based information to support decision-making in invasive species management worldwide. Leveraging the CABI-led **Plantwise** programme will optimise the existing role of stakeholders in established plant health systems and demonstrate increased value-for-money.

CABI will promote a unified and collaborative invasive species management network which can share knowledge, experiences and capacity. In this way, experts who are specialists in particular fields (eg horticulture, maize, conservation) can work together across sectors. The programme will coordinate their skills to provide practical and authoritative invasive species knowledge and solutions to those who need it – from farmers to policymakers – to deliver sustainable impact.

This report provides information on the development of the programme and details of its design, followed by an update on the pre-implementation activities for the programme, from 2014 to the end of 2016. Some of CABI's early work in relation to fall armyworm is included, together with the planned next steps for the programme and a brief summary of the funding that will be required for these steps.

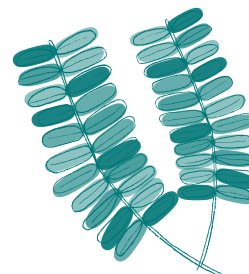
A photograph of a man in a blue long-sleeved shirt leaning over and examining plants in a field. The background shows a line of trees and a clear sky.

**INVASIVE SPECIES
ARE ESTIMATED TO
COST THE GLOBAL
ECONOMY OVER
US\$1.4 TRILLION**

Programme background and design

Programme background

CABI's member countries, in particular those in Africa and Asia, identified invasive species as a real and present danger to their agricultural economies. Invasive species such as mesquite, parthenium weed, cassava brown streak virus, fruit fly, and tomato leaf miner, were reported to affect livelihoods of farmers, the tourism industry, large and minor irrigation systems, biodiversity, loss of plant genetic resources and livestock production. The lack of collaboration, coordination and knowledge about the impacts and potential solutions were identified as the main barriers to effective invasive species management at the national and regional levels.



MESQUITE

Programme design

The invasive species programme will therefore be a regional, cross-sectoral partnership programme, involving a coalition of stakeholders that will adopt a systems-based approach to managing biological invasions across sectors, in three stages:

- **Prevention** – development and implementation of biosecurity action plans; raising awareness of threats at the local level, including through mass media campaigns; and preventing arrival and spread.
- **Early detection and rapid response** – development and implementation of surveillance and emergency action plans for detecting and eradicating listed species; and building capacity to implement these plans.
- **Control and restoration** – evaluating and scaling up existing invasive species management solutions (including stakeholder engagement and embedding control options in policies); and developing and scaling up new solutions to make sure that those living in rural communities have best practice and locally adapted solutions and are actively engaged in running them.

To pursue this three-stage approach the programme will (and has already started to) develop information resources and tools that disseminate information and data to support all activities, including diagnosis, species distribution, risk assessment and introduction/spread prevention.

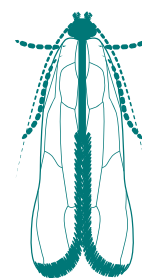
Further information on the programme design is provided in Annex 1.



PARTHENIUM



FRUIT FLY



TOMATO LEAF MINER

Progress of pre-implementation activities 2014–2016

During the period 2014 to 2016 CABI carried out pre-implementation activities for the invasive species programme in three areas: building the evidence base on invasive species and their impacts, raising awareness of the problem and preparatory activities to lay the foundation for implementation of the programme. The achievements in these three areas are described below.

Building the evidence base

During the pre-implementation phase in 2014–2016, CABI sought to generate an evidence base for linking invasive species' impacts to livelihoods in developing countries (for example, impacts on national agricultural production of major crops and incomes, or on the livelihoods of smallholder farmers, pastoralists and other rural livelihoods). Details include the following:

Socio-economic studies of the impacts of invasive species in representative rural livelihood systems in sub-Saharan Africa. In these studies, pastoralists and farmers in Kenya, Tanzania, Uganda and Zambia were surveyed on erect prickly pear (*Opuntia stricta*), parthenium weed (*Parthenium hysterophorus*), Siam weed (*Chromolaena odorata*), Lantana (*Lantana*

camara) and tree marigold (*Tithonia diversifolia*). For each country, information about the impacts of specific invasive weeds was collected via a survey covering approximately 200 people.

Among other results, these studies identified when the species arrived, their economic impact on study participants and the practices used in communities to control them. The results were published in various journal articles.

An analysis of mixed maize farming systems in six countries (Ethiopia, Kenya, Malawi, Rwanda, Tanzania and Uganda) to estimate the **economic impacts of five major invasive species on national economies and rural livelihoods**. The study estimated current cumulative annual production losses to smallholders of US\$0.9–1.1 billion across the five countries, expected to rise to US\$1.0–1.2 billion over the next five to 10 years.

A three-day expert consultation in Naivasha, Kenya, brought together 28 international researchers working in the field of mosquito vectors and invasive plants to explore emerging evidence that invasive plant species are attractive to malaria vectors (*Anopheles* species) and may be enhancing mosquito demographic parameters by providing sugar sources and suitable habitats. The consultation found sufficient evidence to demonstrate that there is a link between vector capacity, higher mosquito survival and increased biting frequency in the presence of particular plant species.

A multi-authored review paper by participants at the malaria link consultation which consolidates existing information on malaria vectors and invasive plants (forthcoming in 2017 in *Parasites and Vectors*).

An impact **case study** (analysing 10 studies in depth) of biocontrol to manage invasive species, regarding effects on crop productivity as well as broader impacts on livelihoods, food security, economies and conservation, and regarding cost–benefit.

Highlights of this case study include: the finding that the introduction of a natural enemy to cassava mealybug, which had affected the food security of over 200 million people, had a benefit to cost ratio in the range of between 199:1 and 738:1; and the finding that the establishment of a natural enemy of mango mealybug, which caused huge crop losses across west Africa, increased fruit production dramatically, with a benefit of \$500 million in Benin alone and a benefit to cost ratio of 808:1 in sub-Saharan Africa.

HIGHLIGHTS

Studies on invasive species impacts on rural livelihoods

International expert consultation on the link between invasive plants and malaria

Study of biocontrol impacts on invasive species populations

Policy analysis of national legislative environment in relation to invasive species

Review of information tools for management of invasive species

Seven articles on invasive species and their impacts on the economy and livelihoods published in peer-reviewed journals

Chapter published in **2017 book** on the impact of biological invasions on ecosystem services

An independent review on available information tools and data resources to support practical invasive species management actions on the ground, with a focus on prevention, early detection and control.

The review concluded that the main gap in the offerings of existing invasive species web-/compendia-based products is that these do not serve decision-makers and practitioners, such as quarantine officers, protected area managers, plant protection officers and risk assessors, who are key actors in a comprehensive system approach to dealing with invasive species.

An analysis of environmental and agricultural policies in Pakistan to understand the background to the country's efforts to prevent, detect and control invasive species, and a review of all five Pakistan national reports (between 2000 and 2015) that have been submitted to the Convention on Biological Diversity. These analyses will inform relevant next steps for the invasive species programme in Pakistan.

Annex 2 provides a list of the CABI publications produced as part of building the programme evidence base.

Raising awareness

During the pre-implementation phase in 2014–2016 CABI sought to create awareness within stakeholder groups of the urgency of the problem of invasive species and their impacts, and the need to tackle the problem. Details include the following:

An **awareness-raising website** was launched to highlight the issue, and e-newsletters were sent out. The website informs visitors about the impacts of invasive species, and invites them to hear from the people affected, learn more about some of the most problematic species, read the research and sign up to receive newsletters and information.

HIGHLIGHTS

Invasive weed management guides developed through expert consultations and disseminated

Website on invasive species created (www.invasive-species.org)

Invasive species programme promoted at international events (eg COP13, EcoSummit)

Worked with **SciDev.Net** on an invasive species awareness campaign

Social media engagement

The website had more than 15,000 page views in 2016.

A brochure was created to illustrate the breadth of impacts on livelihoods, augmented with stories from real individuals trying to cope with invasive species around the world.

Videos were developed covering 10 high impact invasive species in Africa and Southeast Asia.

Social media activities were carried out, including regular blog posts on the topic and tweets on Twitter.

CABI attended high profile international events to raise awareness of the problem and to promote the invasive species programme. These included the UN's biodiversity conference in Cancun, Mexico, (**COP 13**) and the EcoSummit in Montpellier, France.

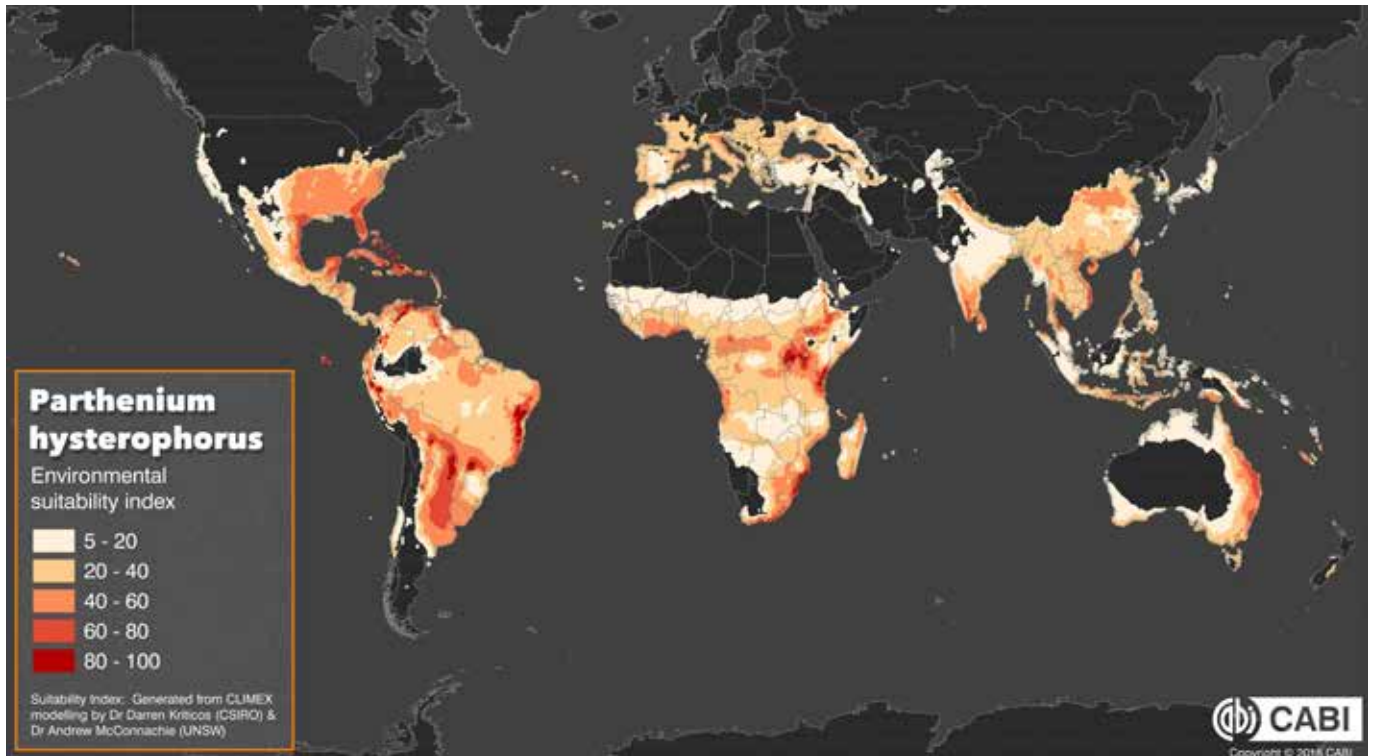
CABI organised three expert consultations (two in Kenya and one in Thailand) to begin prioritising species for prevention, early detection and control, and to develop content for advisory factsheets in Africa and Asia.

Experts from a variety of national institutions (eg agricultural organisations, governmental departments and universities) prioritised weed species and developed content for factsheets with simple and country-specific information on weed management and control, emphasising non-chemical control where possible, based on the Plantwise pest management decision guide template.

As a result of these three meetings over **100 weed management guides** and descriptive factsheets were published on CABI's Plantwise Knowledge Bank, covering the worst invasive weeds in the nine participating countries. Since October 2016, these advisory materials have been accessed over 1,000 times.

CABI worked with **SciDev.Net** on an invasive species awareness campaign which featured a total of seven online news stories, two of which were published by the end of 2016, with an estimated reach of more than 600,000 readers.

One widely read article reported on **papaya mealybug** in Pakistan, and how the augmentation of a parasitoid wasp resulted in over 80% control of the problem species, proving the value of this biocontrol measure, which is cost-effective and pesticide free, and without which papaya farming might have been completely wiped out in Pakistan.



Preparing for programme implementation

During the pre-implementation phase in 2014–2016 CABI carried out preparatory activities to lay the foundation for the full implementation of the programme. In more detail:

In CABI's regional consultations, CABI's 48 member countries across Africa, Asia and the Americas identified invasive species as a real and present danger to their agricultural economies and identified invasive species such as mesquite, parthenium weed, cassava brown streak virus, fruit flies and tomato leaf miner, as affecting farmers' livelihoods, the tourism industry, irrigation

systems, biodiversity and livestock production. Barriers to effective invasive species management were also identified as being a lack of collaboration, coordination and knowledge about impacts and potential solutions.

CABI carried out an analysis of some of the most significant invasive plant species which are posing a threat to protected areas. A modelling approach was used to estimate the potential range of these species. These maps raise awareness of the potential scale of invasive species impact and highlight which protected areas are at risk.

CABI developed a replicable and quantitative method to determine which invasive species could be prioritised within a country and region. CABI made use of both its Invasive Species Compendium and Plantwise data, which provide a good level of confidence. Triangulation of results will be done through stakeholder consultation.

CABI developed wireframes for new risk forecasting tools to test their possible use for invasive species prevention and awareness activities.

The aim is for these tools to help quarantine officers and other professionals to record and identify priority invasive species. These tools are currently being built, with significant progress made on their development so far.

CABI developed the programme strategy, theory of change, logical framework and work plans. The programme strategy was endorsed by CABI member countries in 2016.

HIGHLIGHTS

Consultations with CABI member countries in which the problem of invasive species was recognised

Developed distribution maps of invasive species that pose a threat to protected areas

Developed tools and methodologies for implementation stage

Developed key documents for programme implementation (including strategy and theory of change)

The case of fall armyworm: demonstrating the need for a systems-based response

Introduction

In 2016 the fall armyworm, a major pest in the Americas, was found in Africa for the first time and further suspected cases have been **reported** through CABI's network of plant clinics. Since then it has rapidly spread across much of sub-Saharan Africa. The caterpillar feeds on more than 80 different plants, but maize is its preferred host, the most widely grown crop in Africa and a staple for half the continent. Data from the Americas show heavily infested maize can lose 60-80% of yield. In the context of Africa's climate, the insect is now likely to build permanent and significant populations in West, Central and Southern Africa, and spread to other regions when temperatures are favourable, posing a major threat to food security.

CABI's response

Under its Plantwise programme, CABI **generated awareness** of the issue at local and governmental levels, and issued practical identification guides and management factsheets for smallholder farmers to help them manage the outbreak. This work was carried out in anticipation of donors recognising the issues and funding a coordinated response that would avoid major losses, leading to multiple impacts on maize prices, cross border trade and food security.


CABI also developed a template response plan for affected African countries. This template plan included planning and actions needed from a prevention, early detection and control perspective.

Impact of fall armyworm and need for a coordinated approach

The ongoing outbreaks of fall armyworm in west-central Africa are causing major losses: in Ghana, an estimated US\$160m of losses are expected in 2017 due to the invasion. Fall armyworm is not an isolated case: within the last few years we have seen other biological invasions spread across Africa, including tomato leaf miner (*Tuta absoluta*) and maize lethal necrosis disease, with severe impacts on livelihoods in vulnerable communities. All of these cases could have been predicted and better dealt with if a more coordinated, systems-based approach had been in place. It is this vacuum that CABI's invasive species programme seeks to fill.

Planned future work under CABI's invasive species programme

The invasive species programme is working with local and national partners in Ghana on the coordination of a response plan for fall armyworm. This work involves action plans that put new protocols and available solutions into practice, as well as a study to collate evidence of fall armyworm's impact and best practice solutions. Going forward, building upon Plantwise, the invasive species programme will work with local actors to develop and strengthen additional extension approaches to facilitate best practice solution implementation at scale.



IN GHANA, AN ESTIMATED US\$160 MILLION OF LOSSES ARE EXPECTED IN 2017 DUE TO FALL ARMYWORM

A young boy with short, dark hair is looking directly at the camera with a thoughtful expression. He is wearing a long-sleeved plaid shirt in shades of orange, blue, and white. His hands are clasped together near his chin. The background is a soft-focus outdoor setting with green foliage.

**THE INVASIVE
SPECIES PROGRAMME
WILL REACH BETWEEN
50,000 AND 100,000
RURAL HOUSEHOLDS
BY THE END OF 2017**

Next steps

As the previous sections have shown, CABI's pre-implementation activities have succeeded in laying the foundation for the invasive species programme, by establishing the evidence base on invasive species and their impacts on the economy and livelihoods, raising awareness of the problem and preparing for programme implementation. The task now is to build on this strong foundation by moving to implementation of the programme.

The paragraphs below set out the planned next steps for the invasive species programme. These are categorised as: the next steps that are being pursued within the current funding, and the next steps for much wider work that will be pursued only if further funding is secured.

Next steps under current funding

CABI will hold expert consultations in Ghana and Pakistan to share knowledge on, and prepare a response to, specific invasive species. In both countries, CABI will organise multi-stakeholder consultations involving the government, universities and institutes, civil society organisations, key donors and the private sector to discuss a national response to specific invasive species: fall armyworm in Ghana and parthenium weed in Pakistan. The objective is to share information and draft an initial comprehensive action plan in the short, medium and long term. These countries and species were chosen as a proof-of-concept: the invasive species programme will aim to consult with stakeholders regionally to assess which other invasive species should be included in the future as the programme develops.

Generating partnerships and policy awareness

- In Ghana, CABI will work with local and national partners to get agreement on the coordination of a response plan for fall armyworm.
- In Pakistan, local and national partners will be engaged to identify data and information needs, and opportunities to control parthenium weed.

Building capacity in support of prevention, early detection and rapid control, and best management practice implementation

- In Ghana, a fall armyworm study will be undertaken to collate evidence of impact at household and national levels and best practice solutions, alongside further work with private sector companies to understand the latest biological control and virus-based control measures.

- In Pakistan, an action plan will be implemented to validate gender-responsive and environmentally sound technologies for management of parthenium weed. These activities will be linked to policy advocacy and awareness-raising activities designed to improve the profile of invasive weeds and biological control in Pakistan.

Reaching and advising rural households about biological invasions

- The programme will reach between 50,000 and 100,000 rural households with new knowledge on invasive species management by the end of 2017 through:
 - facilitating awareness raising and dissemination of best practice advice
 - working towards facilitating local production, releasing and monitoring of plant protection products compatible with integrated pest management
 - encouraging business plans that contribute to local employment opportunities for gender and youth
 - working with rural communities and local actors to collect and analyse the baseline situation of target biological invasions, as well as their impacts on livelihoods and their impacts at the household level
- In Ghana, the programme will work with the Plantwise mass extension campaigns for fall armyworm.
- In Pakistan, surveys will be conducted to understand the socio-economic impacts of parthenium weed from a gender perspective and a communication campaign will be initiated to raise awareness of the problems caused by parthenium weed.

Developing invasive species information resources and tools

- Based on the wireframes developed in the pre-implementation phase, CABI will build a 'horizon scanner' decision-support tool for key practitioners in invasive species prevention, management and control, to support country fieldwork.
- In Ghana, the programme will carry out citizen science fact-finding surveys to understand male and female farmers' perceptions of information access and their likely participation in crowd-sourcing activities.
- In Pakistan, the programme will undertake knowledge-sharing activities in relation to parthenium weed.

Next steps with further funding

Subject to securing the funding discussed below, these paragraphs set out CABI's plan to implement the invasive species programme at scale by fully implementing the programme strategy that was unanimously endorsed at CABI's Review Conference in 2016. This will involve similar activities to those described above in the Ghana and Pakistan cases, but at a far greater scale, in many more countries, and tackling far more invasive species.

CABI is seeking a US\$50 million investment to implement the invasive species programme globally, with the aim to protect and improve the livelihoods of 50 million poor rural households impacted by the worst invasive species, using an environmentally sustainable, regional approach to comprehensive management. The money will be spent on five main activities:

Collection and sharing of data and knowledge

- The programme will create dedicated knowledge tools, building on CABI's successful **Invasive Species Compendium** and **Plantwise Knowledge Bank**. These tools will enable interaction between the people who require information about invasive species and the organisations that possess it. CABI will develop an online/offline data management system to enable exchange between all end-users.

Fostering the right partnerships

- CABI will convene an international conference in 2018 to exchange policy and research information and experiences. Invitees will include relevant government officials, advisers and civil servants who are responsible for areas that are impacted by invasive species, and key scientific partners in invasive species research and development.
- The programme will continue to foster the right partnerships at the appropriate regional, national and local levels, and some investment will go towards making sure the programme is steered by appropriate actors and key stakeholders.

Building capacity in support of prevention, early detection and rapid control

- The programme will develop and strengthen risk-driven surveillance and response protocols in line with international guidelines, using innovative approaches to support diagnosis and surveillance for priority species.
- The programme will carry out research and engagement with known researchers to identify the best practice solutions for specific problem invasive species. This will include technology transfer and corroborating the evidence base to check that historic research is still valid.

Community-level action

- The majority of investment will be targeted towards the community level, making sure that best practice solutions are not only available for people living in rural communities, but that these local communities are actively engaged in running them – for example, staffing facilities for augmenting a biocontrol agent and monitoring release and impact.

Monitoring and evaluation, and cross-cutting areas of work

- Monitoring and evaluation, as well as gender empowerment and youth inclusion, will be cross-cutting themes of the programme. The programme will ensure that costs for these cross-cutting themes are integrated into the whole.



Donor acknowledgement

The invasive species programme will help to reverse the invasive species threat which has an annual economic impact estimated at more than US\$1.4 trillion worldwide, and will improve the livelihoods of 50 million rural disadvantaged families in Africa and Asia who are currently suffering, or are at threat of suffering, significant crop and livestock losses. To achieve this aim, CABI seeks an investment of US\$50 million.

Most of the reported activities (2014–2016) were supported by the UK Department for International Development (DFID) and the Australian Centre for International Agricultural Research (ACIAR) as well as by CABI's Designated Fund. The work on investigating the link between invasive plants and malaria was funded through a Bill & Melinda Gates Foundation grant.

We thank our donors for their support of our work.



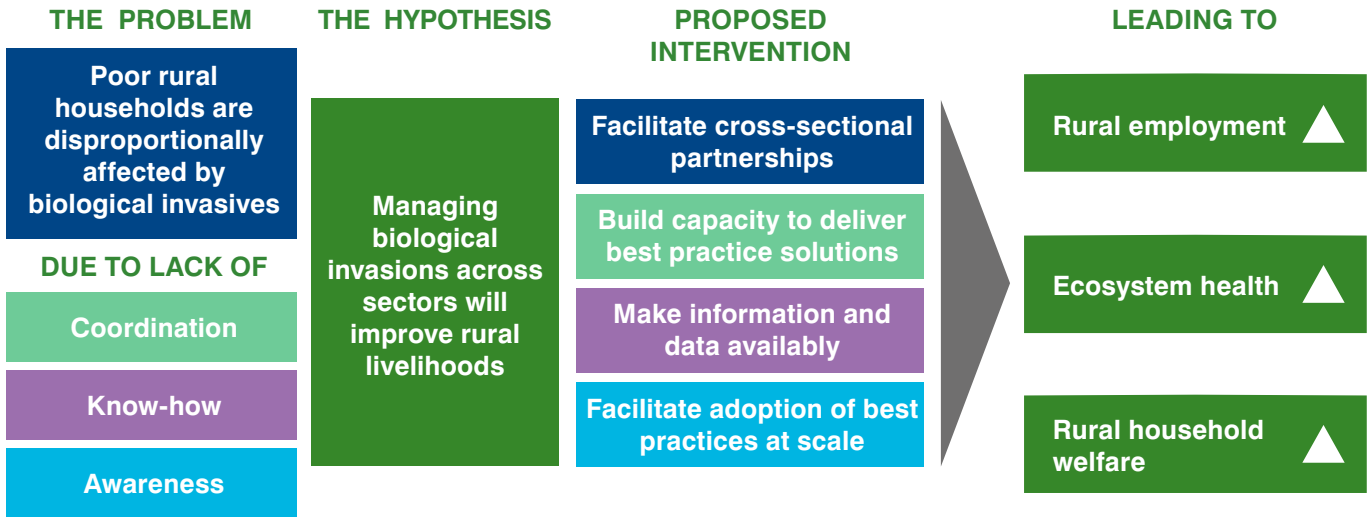
**WITH FUNDING WE AIM TO
IMPROVE THE LIVELIHOODS OF
50 MILLION RURAL FAMILIES
IN AFRICA AND ASIA**



Annex 1: Additional information on programme design

The diagram below sets out the problem the invasive species programme will solve, and the proposed interventions under the programme.

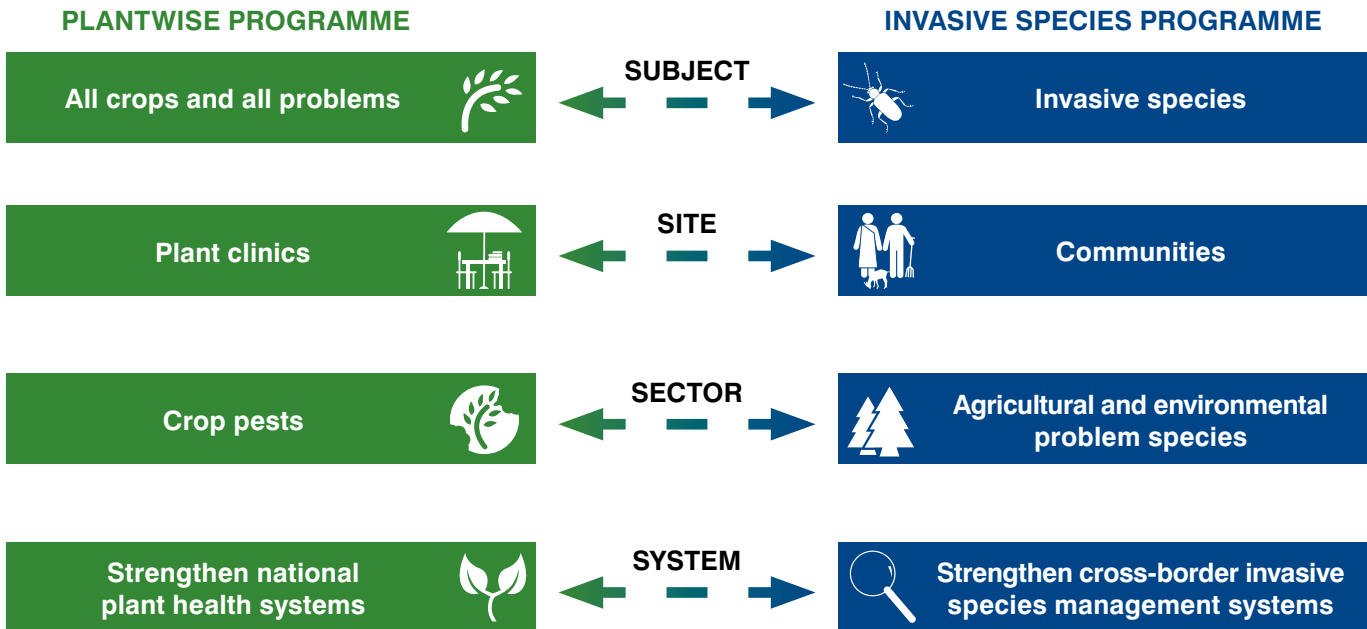
Figure 1: Problem of invasive species and proposed interventions under CABI’s invasive species programme



Complementarity with CABI’s Plantwise programme

The invasive species programme will be complementary to CABI’s Plantwise programme but will have a different purpose. Whereas Plantwise provides national plant health systems with near-to-real-time data on new and emerging pest outbreaks, the invasive species programme will focus on dealing

in a cross-border way with major, invasive problem species which need a solution at scale, by providing ‘targeted campaigns’ in regard to these new problems, including bringing pest solutions to rural communities for collective action. The diagram below sets out the differences between the two programmes.





Annex 2: Publications produced as part of programme development

Peer reviewed publications

Pratt, Corin F., Constantine, K. L., Murphy, S. T. (2017) **“Economic impacts of invasive alien species on African smallholder livelihoods”**, *Global Food Security*.

Witt, A., Kiambi, S; Beale., T. and van Wilgen, B. W. (2017) **“A preliminary assessment of the extent and potential impacts of alien plant invasions in the Serengeti-Mara ecosystem, East Africa”**, *Koedoe – African Protected Area Conservation and Science* 59(1)

Shackleton, R. T., Witt, A., Piroris, F. M., van Wilgen, B. W. (2017) **“Distribution and socio-ecological impacts of the invasive alien cactus *Opuntia stricta* in eastern Africa”**, *Biological Invasions*

Shackleton, R. T., Witt, A. B. R., Aool, W., Pratt, C. F. (2017) **“Distribution of the invasive weed, *Lantana camara*, and its ecological and livelihood impacts in eastern Africa”**, *African Journal of Range and Forage Science*,

Shackleton, R. T. Witt, A. B. R., Nunda, W., Richardson, D. M. (2016) **“*Chromolaena odorata* (Siam weed) in eastern Africa: Distribution and socio-ecological impacts”**, *Biological Invasions* 19(4)

Cock, M. J. W., Day, R. K., Hinz, H. L., Pollard, K. M., Thomas, S. E., Williams, F. E., Witt, A. B. R., Shaw, R. H. (2016) **“The impacts of some classical biological control successes”**, *CAB Reviews* 10(42), 58 pp.

Cock, M. J. W., Beseh, P. K., Buddie, A. G., Cafá, G. and Crozier, J. (2017) **“Molecular methods to detect *Spodoptera frugiperda* in Ghana, and implications for monitoring the spread of invasive species in developing countries”**, *Scientific Reports* 7(4103), 1-10.

Field guides

Editor: Witt, A. (2017) **Guide to the naturalized and invasive plants of Southeast Asia.**

Editor: Witt, A. (2017) **Guide to the naturalized and invasive plants of Laikipia.**

Editors: Luke, Q and Witt, A. (2017) **Guide to the naturalized and invasive plants of Eastern Africa.**

Book chapter

Witt, A. (2017) “Use of Non-native Species for Poverty Alleviation in Developing Economies”. In: **Impact of Biological Invasions on Ecosystem Services**, Vilà, Montserrat; Hulme, Philip E. (eds.).

Presentations

Murphy, S. T. (2015) “Galvanizing action for the management of invasive alien species”. In: Thapa, G. J., Subedi, N., Pandey, M. R., Thapa, S. K., Chapagain, N. R. and Rana, A. (eds.) *Proceedings of the International Conference on Invasive Alien Species Management, National Trust for Nature Conservation Biodiversity Conservation Centre, Sauraha, Chitwan, Nepal, 25–27 March 2014*. National Trust for Nature Conservation, Kathmandu, Nepal, pp. 1–6.

Murphy, S. T. and Subedi, N. (2015) “Implementing management of invasive alien species: learning from global experiences with invasive plants to optimize the way forward”. In: Thapa, G. J., Subedi, N., Pandey, M. R., Thapa, S. K., Chapagain, N. R. and Rana, A. (eds.) *Proceedings of the International Conference on Invasive Alien Species Management, National Trust for Nature Conservation Biodiversity Conservation Centre, Sauraha, Chitwan, Nepal, 25–27 March 2014*. National Trust for Nature Conservation, Kathmandu, Nepal, pp. 161–168.

Witt, A. (2015) *Opuntia Biological control in Kenya. Ecology & Management of Alien Plant Invasions* (EMAPI) conference. Hawaii, USA.

Poster

CABI (2016) **“Tackling invasive alien species to reduce biodiversity losses and improve livelihoods”**, presented at the 2016 Communication, Education and Public Awareness (CEPA) Fair at the Convention on Biological Diversity Conference of the Parties 13, Cancun Mexico.



ESTIMATED ANNUAL PRODUCTION LOSSES OF US\$0.9 BILLION TO SMALLHOLDERS IN 5 AFRICAN COUNTRIES, IS EXPECTED TO RISE TO US\$1.2 BILLION OVER THE NEXT 5 TO 10 YEARS

Funding support, direct and indirect through **CABI's Development Fund**, from the **UK Department for International Development (DFID)**, the **Bill & Melinda Gates Foundation** and the **Australian Centre for International Agricultural Research** has made possible the activities reported in this document.



To find out more and discuss how you can get involved in this exciting new initiative, contact either of the following:

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