STDF PROJECT GRANT APPLICATION FORM

The Standards and Trade Development Facility (STDF) offers grants for projects that promote compliance with international SPS requirements. Eligible organizations can apply for STDF project funding using this form. Applicants can request up to a maximum of US$1,000,000 for projects that have a duration of three years or less.

The STDF Working Group makes decisions on requests for STDF funding. The following types of projects are given favourable consideration:

- Projects relevant to the identification, development and dissemination of good practice in SPS-related technical cooperation, including projects that develop and apply innovative and replicable approaches;
- Projects linked to STDF work on cross-cutting topics of common interest;
- Projects that address SPS constraints through regional approaches; and
- Collaborative and inter-disciplinary projects focused on the interface / linkages between human, animal and plant health and trade, and benefiting from the involvement of two or more partners or other relevant organizations.

Complete details on eligibility criteria and other requirements are available in the *Guidance Note for Applicants* on the STDF website (www.standardsfacility.org). Please read the *Guidance Note* before completing this form. Completed applications should be sent by email (as Word documents) to STDFSecretariat@wto.org.

Project Title	**F³: "FRUIT FLY FREE"** Establishment and maintenance of fruit production areas free and under low prevalence of fruit fly pests in Southern Africa
Objective	The main objective of the project is to establish and develop a framework for maintenance of areas free and under low prevalence of fruit fly pests in South Africa and Mozambique
Budget requested from STDF	US Dollar 721 584
Total project budget	US Dollar 2 893 259
Full name and contact details of the requesting organization(s)	Agricultural Research Council (**ARC**) P.O. Box 8783, Pretoria 0001, South Africa. Contact: Tertia Grové. E-mail: tertia@arc.agric.za; Tel: +27 137537000 Department of Agriculture Forestry and Fisheries (**DAFF**), South Africa, Directorate Plant Health, Private Bag X14, Gezina 0031, South Africa. Contact: Jan Hendrik Venter. E-mail: janhendrikv@daff.gov.za; Tel: +27 123196384 Citrus Research International (**CRI**), PO Box 28, Nelspruit/Mbombela 1200, South Africa. Contact: Aruna Manrakhan. E-mail: aruna@cri.co.za; Tel: +27 137598000 Stellenbosch University (**SU**), Department of Conservation Ecology and Entomology, Faculty of AgriSciences, Private

	Bag X1, Matieland 7602, South Africa. Contact: Dr Pia Addison. E-mail: pia@sun.ac.za; Tel: +27 218084671 Eduardo Mondlane University (**EMU**), Faculty of Agronomy and Forest Engineering, Main University Campus, Avenue Julius Nyerere, Building No. 1, Maputo, Mozambique. Contact: Domingos R. Cugala. Email: dcugala@uem.mz or dcugala@gmail.com; Tel: +258823148430 Ministry of Agriculture and Food Security, National Directorate of Agriculture and Silvaculture, Department of Plant Protection (**DSV**). Endereço: Recinto do IIAM, Pavilhao Novo 1º Andar direito, Av das FPLM nº 3658, Maputo; CP 3658, Moçambique. Contact: Antonia Vaz. Email: avaz5099@gmail.com or dsanidadevegetal@gmail.com Tel: +258 846988646 Royal Museum for Central Africa (**RMCA**), Department of Biology, Leuvensesteenweg 13, B3080 Tervuren, Belgium. Contact: Marc De Meyer. Email: demeyer@africamuseum.be ; Tel: +32 2 7695360
Full name and contact details of contact person for follow-up	Agricultural Research Council-Tropical and Subtropical Crops (**ARC-TSC**). Private Bag X11208, Nelspruit/Mbombela 1200, South Africa. Contact: Tertia Grové. E-mail: tertia@arc.agric.za; Tel: +27 137537000.

I. BACKGROUND & RATIONALE

1. Relevance for the STDF

The Standards and Trade Development Facility (STDF) supports developing countries in building capacity to implement international sanitary and phytosanitary (SPS) standards, guidelines and recommendations. This project aims specifically at developing a regionally harmonised framework for development, implementation and recognition of Pest Free Areas (PFA) and Areas of Low Pest Prevalence (ALPP) for regulated fruit fly pests of commercial fruit commodities in southern Africa (i.e. South Africa and Mozambique) following the directives of the relevant International Standards for Phytosanitary Measures (ISPMs), as approved by the International Plant Protection Convention (IPPC).

A number of fruit fly species are insect pests which restrict export of fruit from many regions of the world including Africa and southern Africa. Countries importing fresh fruit and fresh fruit products require that these commodities be free of fruit fly pests. Pre-harvest and post-harvest measures form part of control packages for fruit fly pests in fruit production systems. However, these measures perform less efficiently at high pest pressure. Many fruit production systems with local fruit fly pests in Africa are also at risk of introduction of invasive exotic fruit fly pests due to increasing trade and movement of people within Africa and between Africa and the rest of the world. Establishment of pest free areas in fruit production regions would entail early detection and exclusion measures for exotic fruit fly pests. Establishment of areas of low pest prevalence for local fruit fly pests would render an effective fruit fly management system and would enable the implementation of a systems approach for managing fruit fly risk in commercial fruit in particular for those fruit types which are less susceptible to fruit fly infestation.

The project being proposed is on establishment and maintenance of PFA and ALPP of specified regulated fruit fly pests in South Africa and Mozambique following ISPM 26, Establishment of pest free areas for fruit flies (Tephritidae), ISPM 35, Systems approach for pest risk management of fruit flies (Tephritidae), Annexure 1, Establishment of areas of low pest prevalence for fruit flies, ISPM

29, Recognition of pest free areas and areas of low pest prevalence, and ISPM 37, Determination of host status of fruit to fruit flies (Tephritidae). Other general standards would also be followed as a result such as, ISPM4, Requirements for the establishment of Pest Free Areas, ISPM 6, Surveillance, ISPM 8, Pest status, and ISPM 9, Eradication. As such, the project addresses good practices in SPS, by safeguarding and improving at a regional scale, the production of a number of main horticultural commodities in the southern African countries involved. It will assure them of continued or new market access by adherence to requirements for export of fruit free of fruit fly pests. Importantly, it will protect and promote the fruit industry, an important economic driver in the countries concerned, resulting in income for the farmers, revenue for the government, job creation and opportunities for further development of the sector. National Plant Protection Organisations (NPPOs) from South Africa and Mozambique as well as public and private research institutions are participating in the project. The project will create a framework for the development of fruit fly free areas and areas of low fruit fly prevalence which could be adopted in other African regions.

STDF provided a Project Preparation Grant for this project (STDF/PPG/567) entitled "Establishment and maintenance of fruit production areas free and under low prevalence of fruit fly pests in southern Africa", to Department of Agriculture, Forestry and Fisheries (DAFF), Pretoria, South Africa, and associated partners. The Royal Museum for Central Africa (RMCA), Tervuren Belgium, acted as contractor for this grant and coordinated the different activities. Under the PPG-567, a first workshop was organized in November 2017 in Stellenbosch (South Africa) bringing together the consortium partners, and a number of primary and secondary stakeholders (see table in appendix 6) as defined by the consortium partners, representatives of research institutions, National Plant Protection Organisations (NPPO), fruit industries (associated research institutions and growers' associations) of South Africa and Mozambique as well as a number of consultants conversant with SPS measures in order to discuss the development of PFAs and ALPPs for target regulated fruit fly pests in the region. This implied thus a discussion of the problem and objectives analysis of the topic. The main outcomes of the first workshop were:

- That particular areas in South Africa (deciduous fruit and citrus growing areas) can be considered for recognition of areas free of the exotic fruit fly species: *Bactrocera dorsalis* (Oriental fruit fly) which is a pest which was recently introduced in the north-northeastern parts of the country.
- That the whole of South Africa can be considered free of another exotic fruit fly, *Zeugodacus cucurbitae* (melon fly), recently found in the northern borders of Mozambique.
- That particular areas in Mozambique can be considered for recognition of areas free of the melon fly
- That particular areas in South Africa and Mozambique can be considered for recognition of areas of low prevalence for the Oriental fruit fly
- That particular areas in South Africa can be considered for recognition of areas of low prevalence for *Ceratitis capitata* (Mediterranean fruit fly or Medfly)
- That the current knowledge on the host range and exact distribution for two other important indigenous cryptic fruit fly pests: *Ceratitis rosa* (Natal fly) and *Ceratitis quilicii* (Cape fly) is too insufficient currently to recognize PFA or ALPP for these target species

The recognition of PFA for Oriental fruit fly and melon fly in specified areas of South Africa and Mozambique respectively would enable continued access of fruit commodities from these regions to current export markets and could also help in establishment of new markets. Recognition of ALPP in fruit production regions in South Africa and Mozambique would ensure export markets that adequate risk mitigation measures are being implemented for regulated fruit fly pests. If such areas are established, they would form part of a fruit fly systems approach to manage risk of fruit fly pests in fruit commodities produced in these ALPPs.

Recognized PFAs for some fruit fly pests exist in different parts of the world. In Argentina, Australia and Guatemala, there are designated areas free of Mediterranean fruit fly which are recognized by the Animal and Plant Health Inspection Services of the United States Department of Agriculture[1]. Trade of commercial fruit produced in these PFAs can, as such, be carried out without the need for a specific disinfestation treatment for the fruit fly species of concern. There are a few examples of recognized fruit fly systems approach around the world including Africa. In December 2008, baby squash and baby courgettes produced from Zambia were allowed into the continental United States[2] in accordance with a fruit fly systems approach which included pest exclusion at production site, fruit fly trapping inside and outside of production site and pest excluding packhouse procedures. Maintenance of areas of low fruit fly prevalence (with pest levels specified) outside of the production site was stipulated as part of the import conditions. In October 2014, bananas produced from Philippines in accordance with a fruit fly systems approach were allowed into Hawaii and U.S.

territories[3]. Establishment of low prevalence of fruit fly species in the *Bactrocera* group in banana production areas was part of the requirements in the systems approach. In September 2015, fresh peppers produced from Peru in accordance with an approved fruit fly systems approach were allowed entry into continental United States and the territories[4]. The conditions of import included maintenance of a buffer area of low fruit fly prevalence around pest free pepper production sites.

For development of ALPP in this project, it was pointed out that levels of fruit fly pest prevalence which would enable production of pest free fruit and be acceptable for trading partners would still need to be determined. Determination of appropriate levels of fruit fly prevalence would be based on the relationship between fruit infestation and trapped individuals. This aspect should be resolved in the course of the full project. In addition, the need for a coordinated identification service and database platform for surveillance and monitoring data were recognized.

Subsequent to the first workshop two main activities were conducted by Stellenbosch University (SU, Stellenbosch South Africa):
1. The compilation of a relational database providing all relevant information regarding distribution, host plant range, commercial host production, seasonality, trapping efficiency for the target species
2. The compilation of a cost/benefit analysis with regard to establishment of PFA and/or ALPP for the target species

A first draft of the full proposal was composed by RMCA, Citrus Research International (CRI, Nelspruit South Africa) and E. Mondlane University (EMU, Maputo Mozambique) partners in collaboration with the other consortium partners. This draft was informally presented and discussed with Dr Rui Cardoso Perreira (IAEA) at the 10th International Symposium on Fruit Flies of Economic Importance (23-27 April 2018, Tapachula, Mexico).

A second meeting was organized between June 5 and 7 2018 in Nelspruit (South Africa), bringing together the consortium partners, and a selection of the participants at the first workshop. The full proposal was presented and discussed. The cost/benefit analysis that was conducted by the SU partner was presented (see appendix 7 for the full report, a synthesis is provided under point 8 of the proposal). The main outcomes of the second workshop were:

- A preliminary demarcation of the PFAs both for Melon fly Mozambique and South Africa, and for Oriental fruit fly in South Africa (appendix 9)
- A preliminary demarcation of the ALPPS for Oriental fruit fly for Mozambique and South Africa and for Medfly for South Africa (appendix 9)
- A selection of targeted hosts to be included in the susceptibility trials, in accordance with selected ALPPs in Mozambique and South Africa
- Agreement of a detailed list of activities to be included in the different work packages and logical framework, with indication of WP coordinators, partners and time schedule for completion of the logical framework and budget requirements.

In addition to the meeting with the stakeholders, there was also a skype conference of the consortium partners with the STDF representative where a number of issues could be clarified on both sides and a schedule was proposed for final submission of the project proposal.

At the end of the second workshop it was concluded that:

- The proposed activities are realistic and adequate
- There is ample support by the fruit industry and the NPPO's of both countries for this initiative
- There is a clear benefit to the industry if the planned objectives can be attained
- The completion of the full proposal is feasible within the time allocated by the Project Preparation Grant.

2. SPS context and specific issue/problem to be addressed

The fresh fruit industry of Southern Africa is continuously expanding. High volumes of fresh tropical, subtropical and temperate fruit are being exported from South Africa and Mozambique[5]. South Africa is the second largest exporter of fresh oranges and a top exporter of other citrus types in the world[6]. South Africa is also the third largest producer of deciduous fruit in the southern hemisphere[5]. In the season 2014-2015, net revenues from export of subtropical, citrus and deciduous fruit in

South Africa totalled approximately US $1.6 billion[7]. South Africa recognizes the importance of complying with international SPS regulations in order to participate fully in the global economy, and has developed a sanitary and phytosanitary strategy, including aspects such as development of pest free areas and promotion of regional SPS cooperation[8]. In Mozambique, agricultural produce comprises more than a third of the country's overall exports[9,10], and the annual growth rate of Mozambique's export to SADC countries and the EU has increased over the last years[10]. Nevertheless, horticultural exports are a minor part in the total value of export products, and less than 15% of Mozambique's arable land is under cultivation, allowing a large potential for further agricultural development. The DTIS specifically recommended a sector development strategy that focuses on diversifying into higher value product lines and other export markets with horticultural export (mango in particular) as the principal example. The subsequent crop diversification strategy promoted both by the government of Mozambique and the private sector, led in recent years to a production growth of fresh fruits and vegetables. Mozambique as such has an enormous potential for export of horticultural produce, being one of the main trading partners among the SADC countries, mainly to South Africa.

In addition to bringing important revenues to the southern African countries, fresh fruit industries also contribute significantly to employment in these countries. The citrus and deciduous fruit industries of South Africa employ more than 200, 000 people directly on farm and in packing houses[11]. It is estimated that a total of 1.5 million households are dependent on these two fresh fruit industries. In Mozambique, agriculture is the most important sector, employing 80% of the workforce and accounting for 20% of GDP. The Action Plan for Reducing Absolute Poverty (PARPA) envisages agriculture and rural development as one of the strategic priorities to fight poverty, and improvement in horticultural revenue is an essential part of this.

However, the importance of agricultural production in the national economies and the possibility to exploit such opportunities are seriously undermined due to the rigorous restriction measures imposed by importing countries, because of the risk of introduction of invasive pests. The inability to comply with sanitary and phytosanitary measures can lead to loss of export markets. In 2012, the Ministry of Agriculture, Mozambique, conducted a Phytosanitary Capacity Evaluation (PCE)[12]. In the PCE, the inability of Mozambique to comply with SPS of importing countries was highlighted as a major factor undermining growth of the agricultural sector in the country[12]. Despite the presence of favourable policies, laws, regulatory framework and public private partnership in Mozambique, serious limitations in institutional and financial capacity were raised[12].

Fruit flies have always been considered a major constraint in horticulture in the region. Several major fruit fly pests had and still have a large impact on the fruit production and trade and as such they form one of the main phytosanitary issues in Africa. In a recent study for establishing priorities for SPS capacity-building in Mozambique, among the six top priorities selected, four are related to fruit fly issues[13]. Moreover, in the last decade, the problem is aggravated because of two new developments: the introduction of exotic invasive pests of Asian origin and the recognition that some of the indigenous species are actually a complex of different species with their own ecological thresholds.

In recent years four exotic species of Asian origin were introduced into Africa. Two of these exotic species: Oriental fruit fly and melon fly, currently have wide distribution ranges in Africa and have more recently expanded into southern Africa[14].

The Oriental fruit fly, *Bactrocera dorsalis* (fig. 1; formerly recognized under the name *Bactrocera invadens*), was first detected in East Africa in 2003[14]. Since then, the Oriental fruit fly has spread over large parts of the continent including southern Africa (fig. 1). The pest is present in the whole of Mozambique and in the north and north eastern parts of South Africa. With national action plans and strategic surveillance network in place in South Africa, several major fruit producing areas in the country for example fruit production regions in the Eastern Cape, Western Cape and Northern Cape Provinces, are currently free of the pest. However, the pest free status of these fruit production areas remains at threat with build-up of Oriental fruit fly populations in other parts of South Africa and the southern African region. As such early detection monitoring network for this pest in areas currently free from it should be maintained and intensified in South Africa. The Oriental fruit fly has caused serious losses of commercial mango in Africa[14]. Exports of commercial fruit which are potential hosts for *B. dorsalis* were jeopardized in some African countries where *B. dorsalis* established, resulting in substantial revenue losses for these countries[14].

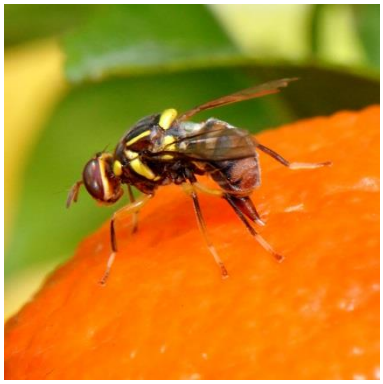

Fig. 1: *Bactrocera dorsalis* (copyright A. Rodriguez)

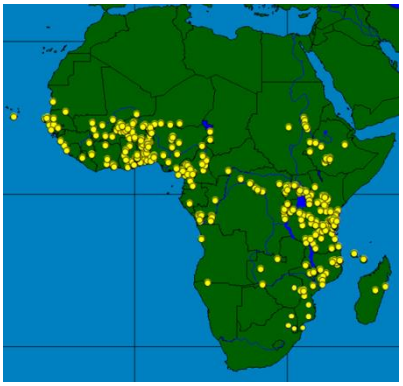

Fig. 2: Distribution of *B. dorsalis* in Africa

The melon fly (fig. 3; *Zeugodacus cucurbitae* formely placed in the genus *Bactrocera*) has been established in eastern Africa at least since the first half of the 20th Century. Over the last 10 years, however, it seems to be expanding its range on the continent. The melon fly was found in northern Mozambique in 2013[15] (fig. 4). Other areas in Mozambique are still considered free of this pest. The melon fly was not detected in South Africa. Although the melon fly is predominantly a pest of cucurbits (for example cucumber, melon, bitter gourd), it has been recorded on other fruit types such as mango and citrus[15]. As such melon fly will be a regulated pest for these fruit types in areas of the region which currently free of the pest.

Fig. 3: *Zeugodacus cucurbitae* (copyright A. Franck)

Fig. 4: distribution of *Z. cucurbitae* in Africa

The impact of these exotic fruit fly pests on market access has been amply demonstrated in the region with the discovery of the Oriental fruit fly in Mozambique in 2008, which resulted in a three weeks ban of South Africa on fruit import from Mozambique. It is estimated that this has led to a loss of revenue of US$2.5 million (from Maputo province only) and about US$1.5 million at Vanduzi Company in Manica province. In many commercial farmers in the central and southern regions of Mozambique, the production and sales of fruit products were significantly reduced and investments in the fruit sector were suspended causing losses of about US$ 23 million. Several parts of southern Africa are currently still free of either or both oriental fruit fly and melon fly, providing the opportunity to demarcate and establish pest free areas for these pests.

The southern African regions are strongly affected by indigenous fruit fly pests. The most important among these in South Africa is Medfly which is an important pest of deciduous and citrus fruit in the country[16]. Of African origin this pest has spread to Europe and the Mediterranean Region in the 19th Century and afterwards to other regions worldwide including Australia, Oceania, Central and South America. It is the subject of some of the most important pest control programmes worldwide such as the MoscaMed programme in Central America (to keep Mexico free of this pest) and monitoring and eradication programs in the USA (in particular the states of California, Texas and Florida). In the Western Cape Province of South Africa it is the subject of the only SIT (Sterile Insect Technique) program against fruit flies in Africa. Export fruit from South Africa destined to lucrative American and Asian markets usually have to undergo post-harvest disinfestation treatment for Medfly and other indigenous pests. These requirements restrict the export of certain fruit types whose quality may be affected by these disinfestation treatments. For those sensitive fruit types which are not

susceptible to fruit fly infestation, development of ALPP together with other measures could be more suitable risk mitigation measures.

For established exotic pests which have a restricted distribution in a country, development of ALPP would minimize movement of these pests and as a consequence protect the PFAs. Exotic and indigenous pests pose a real risk to the horticultural economy of the region. Taking into account the SPS priorities put forward by the governments of South Africa and Mozambique, and their subsequent recommendations of developing fruit fly PFAs or ALPPs in order to safeguard their horticultural industry, the aim of this project is to address such PFA and ALPP development for key regulated fruit fly pests in particular areas of the country.

3. Links with national/regional development plans, policies, strategies, etc.

This project, which addresses the establishment of PFAs and ALPPs for prioritized regulated fruit fly pests, directly supports the SPS strategy of DAFF South Africa and the plant health policy for South Africa. One of the goals of the plant health policy of South Africa is to ensure development of plant health systems that prevent introduction and spread of regulated plant pests[8]. In the DAFF SPS strategy, the need to direct resources for SPS measures such as establishment of pest free areas related to prioritized commodities was highlighted as a means to enable South Africa to exploit more market opportunities[8]. Harmonisation of these SPS measures on a regional basis was also acknowledged as a means to promote intra-regional trade[8].

In Mozambique, the establishment of PFAs and ALPPs for regulated fruit fly pests also directly supports the national SPS strategy which prioritizes the development of an effective phytosanitary system to control the movement of plants and plant materials and prevent introduction, establishment and spread of regulated plant pest. Therefore, the project directly addresses the enhancement of sustainable agricultural productivity and export opportunities (Decreto n° 05/2009). The project also addresses focus areas identified in the PCE conducted in 2012[12] namely NPPO pest diagnostic and control capacity, NPPO pest surveillance and establishment of PFAs and ALPPs. The establishment and maintenance of PFAs and ALPPs for regulated fruit fly species in Mozambique would enable the continuation and even expansion of export of fresh fruit and vegetables from the country.

The proximity of South Africa and Mozambique, the exploration of new markets, and the growing horticultural industry in Mozambique, has led to an increase in movement of plants and plant materials through formal and informal trading between the two countries. In addition, they share large ecological regions that form natural corridors and passage ways for organisms such as fruit flies to disperse naturally. The current agricultural industry in Mozambique is largely driven by small scale, developing agriculture associated with the lack of regular area-wide pest management programmes. In this type of agricultural set up with no area wide insect pest monitoring and control in place, the possibility of introduction of quarantine pests in the country and in the region is high. On the other hand, both countries have active surveillance and monitoring activities ongoing as well as a number of networking and research programs (see below under point 4) which form a good platform for the development of a common project. The current study is, therefore, focusing on these two countries.

National Programs of Surveillance and Monitoring
Several of the partners (indicated in **bold**) were and still are involved in these programs.

For South Africa, the **Department of Agriculture Forestry and Fisheries (DAFF),** industry bodies such as **Citrus Research International (CRI),** agricultural research institutions such as **Agricultural Research Council-Tropical and Subtropical Crops (ARC-TSC),** Department of Conservation Ecology and Entomology at **Stellenbosch University (SU)** and Fruit fly Africa, have been involved in surveillance monitoring of the Oriental fruit fly since 2006. DAFF and CRI also developed a national action plan on the Oriental fruit fly where recommendations for survey, containment and eradication of the pest were provided following early detection in a surveillance network[17]. Since Oriental fruit fly is now established in the north to north-eastern parts of the country[18], the national control strategy continues to focus on preventing further incursions in other pest free areas, slowing the spread of the pest and monitoring the extent of its distribution within the country. This is still ongoing and being directed by DAFF. Local industry partners (grower-based

funding trusts), such as HortGro Science and South African Table Grape Industry (SATI), who are based in the Western Cape of South Africa, stand to gain from their current pest-free status, and would continue to benefit from such a project if more stringent quarantine measures could be put in place, so as to secure their export markets. The Department of Conservation Ecology and Entomology at SU has been involved over the last decade in several research activities related to fruit flies, such as fruit fly monitoring with funds from Hortgro Science and Citrus industry, including postdoctoral activities of partners who are now staff member of other partner institutions like CRI.

The Agricultural Research Council (ARC) is one of the principal agricultural research institutions in South Africa. The ARC conducts research, develop and transfer technology in order to promote agriculture and industry, contribute to a better quality of life, facility natural resource conservation and alleviate poverty. The **Agricultural Research Council-Tropical and Subtropical Crops (ARC-TSC)** formed part of the national fruit fly surveillance network (in collaboration with DAFF and CRI, cf. above) and monitored fruit flies in subtropical fruit production areas together with the Subtropical fruit industry. The Subtropical fruit industry can benefit by such a project in accessing new markets and maintaining current markets.

For Mozambique, this project will complement the fruit fly program that was initiated in 2007 with support of the World Bank and USDA-APHIS, conducted by the **Departemento de Sanidade Vegetal (DSV)** under technical coordination of and implementation by the **Eduardo Mondlane University (EMU)**. Through the fruit fly surveillance program, the South region was declared pest free area for the Oriental fruit fly from 2009 onwards. Because of further spread and establishment, this ceased to be a pest free area in 2011. Due to the current detection of melon fly in the northern region of the country, the government is currently making efforts to determine its current distribution and to establish pest free areas in the central and southern regions.

The **Royal Museum for Central Africa (RMCA)** acted as a recognized institution of expertise for identification and confirmation of intercepted fruit flies during the above mentioned surveillance programs, and actively participated in monitoring activities in Mozambique during USDA-APHIS funded missions.

4. Past, ongoing or planned programmes and projects

Because of recognition of fruit flies being one of the main pest groups in Africa and the region, a number of international and local activities have been deployed in the last decade on matters related to SPS, plant health, and pest control. Several of the partners participating in the PPG application (indicated in **bold**) have been involved in these activities. These activities can be divided in several categories: networking activities, research activities, activities in collaboration with stakeholders and industry. National Programs of surveillance and Monitoring were presented under Point 3 (see above)

Networking activities

ERAfrica (2014-2017) was a European Union project aimed at promoting a unified European approach to collaborating with Africa in the field of science and technology research for innovation and sustainable development. The ERAfrica project was funded by the European Commission, with different institutions in participating European and African countries providing the funding for different project themes. The three year ERAfrica "FRUIT FLY" project started in June 2014, and included as partners **CRI** (as coordinator) (South Africa), **RMCA** (Belgium), CIRAD (Reunion, France) and Centre National de Recherche Agronomique (Ivory Coast). The aims of the project were to develop effective and accurate detection methods for fruit fly pests in Africa and the Indian Ocean region. The specific objectives of the project were to (1) determine the efficacy and sensitivity of different trapping systems for monitoring Afrotropical fruit fly pests, (2) analyse the population genetic structure of key indigenous and exotic fruit fly pests in the Afrotropical region for a better understanding of their geographic ranges and dispersal patterns, (3) develop identification tools for Afrotropical fruit flies and (4) set up a standardised fruit fly detection system in Africa and the Indian Ocean region.

Link to proposal: This ERAfrica project has enabled us to optimize trapping methodologies for surveying purposes, as well as to facilitate the identification process. These practicalities will facilitate the monitoring activities planned for demarcation of PFAs and ALPPs.

FRUITFLYNET (2014-2016) was a networking initiative funded by the Belgian Science Policy (BELSPO) of the Belgian Federal Government. The general objective was to facilitate the creation of a network between a Belgian Federal Research Institution (**RMCA**) and non-European partners in order to initiate a long-term consolidated network. In the particular case of the FRUITFLY network, RMCA developed a network with three other African partners: **SU**, the Sokoine University of Agriculture (Morogoro, Tanzania; SUA) and **EMU**. The network activity focused on and provided funds for organizing meetings to discuss on how monitoring and surveying activities with regard to fruit flies and conducted by these institutions, can be standardized and harmonized.
Link to proposal: through this project, Mozambican and South African partners were able to communicate and exchange information. As such the network initiated the idea to develop regional projects such as this one.

The IAEA Technical Cooperation regional project RAF5062 on "Preventing the Introduction of Exotic Fruit Fly Species and Implementing the Control of Existing Species with the Sterile Insect Technique and Other Suppression Methods" was financially supported by the IAEA and has the aim of sharing among the countries of the Indian Ocean (IO) region the knowledge on the status of tephritid fruit fly pests in each of the participating countries and the control techniques in use, including the possibility of applying the Sterile Insect Technique (SIT), and coordinate the joint efforts required to avoid the introduction of the exotic fruit fly pests. This can be achieved through the strengthening of the quarantine and pest risk analysis for each of the participating countries, and the installation of accurate monitoring system to detect early exotic fruit fly pest introductions, with the objective to eradicate at incipient stages of the invasion to maintain the region free of these pests. This networking initiative included the participation of the Member States of the Indian Ocean Region, including **EMU**, Mozambique. **RMCA** was involved to provide technical expertise. The project was approved for 2012-2015 and had as main outcomes: (1) the National Plant Protection Organizations of Member States in the region networked in terms of increased awareness and technical capacity to prevent or detect and address invasive exotic tephritid fruit fly pest outbreaks and (2) increased technical capacity of some Member States in the region to integrate, as part of a phased conditional approach, the Sterile Insect Technique (SIT). This regional project is succeeded by a new IAEA Technical Cooperation regional project RAF5074 on "Enhancing Capacity for Detection, Surveillance and Suppression of Exotic and Established Fruit Fly Species through Integration of Sterile Insect Technique and Other Suppression Methods" of which a first meeting took place in July 2016, organized by the **EMU** partner, and with active participation of **RMCA** and **SU**.
Link to proposal: the IAEA technical cooperation regional project provided a forum for the consortium partners of South Africa and Mozambique to present their projects, exchange information with partners from other African countries with similar conditions. In addition, the involvement of the IAEA (of which a number of staff members are involved in the IPPC technical group on fruit flies and the development of relevant ISPMs) can provide guidance and assistance in the course of the lifetime of this proposed project and beyond.

Research and capacity building activities

An IAEA Coordinated Research Project (CRP) on "Resolution of Cryptic Species Complexes of Tephritid Pests to Overcome Constraints to SIT Application and International Trade" which was recently completed, provided the taxonomic background on the correct identity for the Natal fruit fly, the melon fly and the Oriental fruit fly. **RMCA** had a coordinating role in a number of the workgroups involved (see De Meyer et al. 2014 for details).
Link to proposal: this CRP has laid the foundation for the correct identification of some of the major pests involved in this proposal.

A number of projects fully or partly funded by **CRI** under the fruit fly research programme of CRI were carried out between 2010 and 2017 to address several aspects relating to potential distribution of the Oriental fruit fly in Africa and southern Africa, ecology and control of the Oriental fruit fly. Many of these projects were completed with results published in peer reviewed journals (See[19, 20, 21, 22])
Link to this proposal: Information on biology and control of the Oriental fruit fly will form the basis for the development and maintenance of pest free areas and areas of pest prevalence for this pest species.

EMU has been involved in several fruit fly projects including Management and mitigation measures for the Oriental fruit fly in Mozambique (funded by FAO, World Bank Group). The completed projects

were: Assessment of ripening stages of Cavendish dwarf bananas as host or non-host to *Bactrocera invadens* (see[23]), non-host status of papaya cultivars to the Oriental fruit fly, in relation to the degree of fruit ripeness[24], effect of a combination of orchard sanitation, GF-120 and MAT in controlling the Oriental fruit fly in Mozambique, establishment and spread of biological control agents against Oriental fruit fly funded by the National Research Fund of Mozambique. **EMU** has also led the establishment of a fruit fly research laboratory in Manica Province with funding from the World Bank and which is currently fully operational.
Link to this proposal: information on (non)host status is essential for recognition of ALLP and systems approach in particular fruit production zones; the research laboratory in Manica is situated in one of the major fruit production areas of the country and as such geographically well placed for conducting experimental work.

Both **RMCA** and **EMU** are partners in a North-South-South (NSS) Project (third partner Sokoine University of Agriculture, Tanzania) funded by Belgian Development Cooperation, aiming at improving IPM methods for mango in Manica Province, Mozambique through spatio-temporal analysis. Both partners have proposed a new project proposal for funding by the Belgian Development Cooperation on agroecology of cucurbit fruit fly pest, including a component on surveys for melon fly in northern Mozambique and southern Tanzania. The proposal concept note is accepted for development of a full proposal. A decision on possible funding is expected in the second half of 2019.
Link to this proposal: the NSS project has generated baseline data on the occurrence and prevalence of the Oriental fruit fly in the main fruit production area in Mozambique which will aid in recognition of ALPP; improved IPM will be essential in systems approach developments in conjunction with ALPP. The newly proposed proposal will complement the surveying activities for melon fly as proposed to establish PFA in Mozambique.

SU, CRI, EMU and **RMCA** have proposed a project proposal for funding by the Belgian Development Cooperation on distribution potential of the Natal fly and the Cape fly in South Africa and Mozambique. This project will also include an advanced training programme in fruit fly identification. The proposal concept note is accepted for development of a full proposal. A decision on possible funding is expected in the second half of 2019.
Link to this proposal: the first workshop indicated that our knowledge for these those fruit fly pests is currently too limited in order to be included for demarcating PFA's or ALPP's. If funded, the project would allow us to fill this knowledge gap so that establishment of such areas can be considered in a future stage. The planned training programme would then also be considered as a financial contribution to the STDF project by matching funds for the training in identification tools.

Projects in collaboration with stakeholders and industry

SU and HortGro Science executed a collaborative project to determine suitability of deciduous fruit hosts for the Oriental fruit fly, and suitability of the Western Cape as a potential area of establishment for the pest by determining its physiological parameters. This project also included assessment of morphological parameters to assist identification of larval tephritids of quarantine significance to southern Africa. Further to this collaboration, another project is currently investigating the use of GIS and the spatio temporal distribution of Medfly in relation to refining area-wide management of this species in the Western Cape Province of South Africa. A new collaborative project between **SU** and CIRAD is testing augmentoria and biological control options against fruit fly pests in the Western Cape, to supplement area-wide pest management programmes.
Link to proposal: One of the areas identified for the development of a pest free area of the Oriental fruit fly in South Africa is the Western Cape Province. Information on the utilization of deciduous fruit, the main commercial fruit type cultivated in Western Cape, by the Oriental fruit fly as well as rapid fruit fly identification methods would be important requirements in the development of pest free areas for this fruit fly pest in Western Cape Province, South Africa. GIS analyses, and skills obtained through various projects, could further support eradication efforts through more precise monitoring of distribution and spread of new invasive species. This approach uses current monitoring data to determine which geographic, topographical and climate data is most influential in determining spatial and temporal distributions.

The fruit fly program in Mozambique led by **EMU** has established a partnership with private sector for the monitoring and management of fruit flies in the country, as well as on research regarding

host status for bananas, papaya, litchi, and chili. EMU has been also assisting farmers on the compliance with SPS plant health measures for market access of fresh fruits and vegetables.
Link to proposal: these activities are in line with obtaining baseline data for PFA and ALPP, directly in conjunction with the fruit industry partners, and will as such facilitate further monitoring and surveillance.

The national exotic fruit fly surveillance program of the **DAFF** started in 2006 and forms part of the strategic plan of the department. It focuses on the early detection of mainly Methyl Eugenol responded fruit flies by maintaining a national network of methyl eugenol and biolure baited traps. Approximately 1500 traps are currently maintained by DAFF and these cover strategic areas such as ports of entry, production areas, urban areas and road transects which cross through not only fruit production areas but also natural vegetation. The national surveillance program acquires supplementary monitoring data from fruit growers who maintain their own traps. The Deciduous industry makes use of FruitFly Africa to set and maintain the exotic fruit fly traps for growers who participate in the Medfly area wide integrated management control project.
Link to proposal: the established network initiated by DAFF, and associated cooperation with the industry, will be the backbone for further surveillance and monitoring activities.

The **ARC-TSC** worked together with various fruit industries and **DAFF** in the national exotic fruit fly surveillance network. The ARC-TSC conducted research funded by the Subtropical fruit industry to determine the relative numbers of indigenous and exotic fruit fly species in subtropical fruit orchards. Host utilization of fruit fly species was also studied. The ARC-TSC worked together with the **CRI** in the evaluation of different male annihilation treatments against Oriental fruit fly. The ARC-TSC and the Department of Agriculture, Rural Development, Land and Environmental Affairs (DARDLEA), Mpumalanga Province worked together to combat the fruit fly problem in Mpumalanga Province. A project was initiated with the aim of creating awareness of the fruit fly problem, and especially of the new invasive species, the Oriental fruit fly. Traps for monitoring the important fruit fly species were deployed in order to determine the diversity, abundance and seasonality of species.
Link to this proposal: Information on relative numbers of fruit flies, the development of effective suppressing methods and host utilization of fruit fly species play an important role in the establishment and maintenance PFA and ALPP.

5. Public-public or public-private cooperation

In the project there will be surveys carried out to characterize (1) areas free of the exotic fruit fly pests: Oriental fruit fly and melon fly in both South Africa and Mozambique, (2) areas of low prevalence of Oriental fruit fly in South Africa and Mozambique and (3) areas of low prevalence of Medfly in South Africa. In South Africa, surveys will entail a collaborative work between different institutions: public and private. The public institutions involved in the South African surveys will be primarily **DAFF, SU** and **ARC-TSC**. The private institutions involved in the South African surveys will be **CRI** and HortGro. DAFF has an MoU with HortGro since 2009 which is renewable every three years to ensure the roll-out of area wide control of the Medfly in selected areas in the Western, Northern and Eastern Cape Provinces in South Africa. The MoU started with the 50/50 cost sharing objective between growers and DAFF with DAFF now contributing approximately 30%. The area wide control is focusing on applying the Sterile Insect Technique(SIT), together with controlled bait sprays and sanitation programs. The SIT rearing facility has the capacity to rear approximately 50 million flies per week. The objective is to gradually lower the Medfly population in the selected areas and to establish areas of low pest prevalence for Medfly. The implementation organization is FruitFly Africa which is commissioned through Hortgro as a subsidiary organization within HortGro.

CRI is a research and technical services organisation based in South Africa that primarily conducts research for citrus growers in southern Africa that belong to the Citrus Growers Association. CRI's research is applicable to small, medium and large scale horticultural producers and exporters. The activities of CRI involve training on standards, facilitation of compliance to international best practices in the industry, collaboration with government and other public and private institutions on activities related to horticulture, and promotion of trade in the southern African horticultural industry. CRI routinely commissions research activities, mainly through consultancy services, on horticultural aspects, and has longstanding cordial relations with public and private organizations in Southern Africa and internationally. HortGro is an industry body which groups three deciduous fruit producers' associations in South Africa namely the Apple and Pear producers' associations, the stone fruit producers' associations and the dried fruit technical services. HortGro focusses on production,

research and technology, communication, markets, and transformation within the deciduous fruit industry. HortGro funds research conducted in different universities in South Africa.
In the project scientifically based levels or fruit fly prevalence would need to be established on specific fruit commodities such as citrus, subtropical and deciduous fruit. This would entail collaborative research activities conducted by CRI, ARC-TSC, SU and other associated universities.

The Agricultural Research Council (ARC) is a premier science institution that conducts research with partners, develops human capital and fosters innovation to support and develop the agricultural sector. The ARC conducts research to benefit subsistence, small-scale and commercial farmers. The ARC works closely together with various private institutions, commodity organizations, higher education institutions and government organizations. The ARC-TSC has close connections with the Subtropical fruit industry, National and Provincial Departments of Agriculture. The ARC-TSC works together with DAFF and the Subtropical fruit industry to facilitate access to new markets.

The project also proposes to develop and disseminate identification tools for fruit fly pests. This aspect will be a collaborative effort between RMCA, Belgium, and project partners within South Africa (public and private).
Finally, the development of a database platform on status of fruit fly pests in South Africa would be developed jointly by SU, CRI, ARC-TSC and DAFF.

The Fruit program in Mozambique has been coordinated by the **DSV** and **EMU** as the National Technical Coordinator with strong partnerships with the private sector, research institutions, Development Agencies, NGOs and specialized regional research centres to address all issues relating to the threat from fruit flies to the Mozambican economy and food sustainability. The private sector has been actively involved in surveillance, management activities, in providing materials for monitoring, research and management of the fruit flies. The fruit fly program has also established a fruit fly working group comprising representatives of the MINAG, EMU, private sector, AGRIFUTURO, and USAID as well as representatives from the NGOs and is chaired by the DSV – MINAG. Representatives from FAO, World Bank (WB), EU and others have been invited to attend the group meeting and discussions.

There has been strong collaboration between DSV/EMU and the South African NPPO (DAFF), with regard to South African market access for Mozambique fresh fruits and vegetables. Several bilateral meetings have been organized by the two NPPOs to discuss issues related to fruit flies in both countries and trade facilitation. The discussions were also based on the principles of SPS plant health and regional and international standards on fruit flies and trade related. The existing bilateral platform will be used to discuss and adopt operational plans developed for maintenance of PFAs and ALPPs for targeted fruit fly pests in both countries.

6. Ownership and stakeholder commitment

An analysis of the different primary and secondary stakeholders was carried out by the consortium partners (cf appendix 6). Representatives of these stakeholders were contacted in order to participate in the development of the proposal (through the two meetings organized) and to provide formal support.

This project has the main support of the National Plant Protection Organisations of both countries involved, i.e. South Africa (through **DAFF**, letter in appendix 4) and Mozambique (through **DSV**, letter in appendix 4). Both institutions are partners in the consortium and will be directly involved in all Work Packages under point 9. DAFF and DSV will, in addition to in kind contributions, also provide direct financial contributions through actions that are already established and that will be incorporated in the activities of the proposal (cf commitments outlined in the respective letters of support, and budget breakdown).

Several growers associations and main horticultural producers also expressed their support (letters in appendix 4). They will be involved by putting at our disposal cultivated areas under their production and facilities for research and surveying activities listed in WPs 2 and 4. They also provide direct financial support as well as in-kind contributions to ongoing activities that will be of assistance to the tasks of the project (cf commitments outlined in the respective letter of support, and budget breakdown). **CRI**, as institution supported by the citrus growing industry, is also directly involved in the Work Packages under point 9. Furthermore, international organisations were contacted and

expressed their support (appendix 4) and are providing financial contributions through, for example, purchase of material.

II. PROJECT GOAL, OBJECTIVE, OUTPUTS & ACTIVITIES (LOGICAL FRAMEWORK)

7. Project Goal / Impact

The project will improve market access, revenues and employment in South Africa and Mozambique with regard to export fruit markets where targeted fruit fly pests constitute risks.

8. Target Beneficiaries

The fruit industries will benefit from this project as this would create opportunities for retention of existing markets for exported fruit and exploration of new markets. The first direct beneficiaries would be fruit producers (small scale and large scale). The retention and expansion of markets would ensure stability and expansion of these fruit industries which would have a ripple effect onto other role players in the industry (farm workers, traders and other role players along the fruit production and trade value chain). The framework for maintenance of pest free areas and areas of low fruit fly prevalence will create an opportunity for development of fruit fly monitoring and control private services which would in turn create job opportunities for pest monitoring and control agents. Consumers, both local and international, would also benefit from assured supply of fruit produce of high quality.

An initial cost benefit analysis was conducted using a status quo approach for South Africa, meaning keeping the situation as it is, maintaining the situation or doing nothing. Therefore, the current markets that can be accessed, because *Bactrocera dorsalis* is absent, is seen as the benefit, while the costs to maintain these markets presently are the costs. The results indicate that for every costs there is a 5,64 benefit, which means that establishing fruit fly free areas will have a positive effect and is cost efficient. This is a course-scale cost benefit analysis, but already indicates a positive outcome for South Africa at least.

(a) Gender-related issues

The role of women in farming is considerable, especially with regard to horticultural activities, and they make essential contributions across the developing world[24]. They often comprise almost 50% of the agricultural labour force in Africa, despite the fact that their workload also includes other chores and household responsibilities. Agriculture is also the most important source of employment for women compared to manufacturing and services. The small-scale cultivation of vegetables and fruits is often a niche developed by women as it can be combined with other tasks that require them to stay near the home (such as caring for children and elderly). Improvement in revenue that can be obtained through these activities can improve the status of women within their society

On the other hand, women are considered a more vulnerable workforce, as shown by a study in the Western Cape Province (South Africa) on the wine and deciduous fruit global value chains[11]. Although the number of women employed in these sectors are increasing, they are usually employed on a casual and seasonal basis (i.e. no permanent full-time contract), enjoying no social benefits and are rewarded lower pay than male colleagues. Any restructuring, for example caused by reduced need for labour because of fruit losses through pests, will affect women labourers in the first place, placing them in an insecure position.

Both for female small scale farmers as for women labour in the industrial horticulture, assuring the growers' position on the market by assisting in providing pest free produce, will provide a more stable financial and resource framework.

9. Project objective, outputs and activities (including logical framework and work plan)

Purpose:

To facilitate fruit export in the main horticultural areas in South Africa and Mozambique.

Outputs:

1. Established PFA areas in South Africa and Mozambique for target fruit fly species
2. Scientifically based evidence for specified low fruit fly prevalence levels for target fruit fly pests
3. Established ALPP areas in South Africa and Mozambique for target fruit fly species
4. Operational database platform for determination of fruit fly status in different regions in South Africa and Mozambique
5. Identification protocol and service for rapid and unambiguous recognition of target fruit fly pests and related taxa
6. Financial model for maintenance of PFA and ALPP for target fruit fly pests

Activities are grouped in Work Packages (WP) with one overall coordination WP (WP1), five WPs dedicated to the specific outputs, and an overarching WP (WP7) dealing with information dissemination, public awareness and legislation.

WP1: Project Management
Objective: To ensure smooth running of the project. This includes:

- communication between partners and STDF, oversee reporting requirements
- general coordination of and communication between the different WPs
- adherence with proposed work plan, and timely delivery of set outputs

WP leader: ARC-TSC
Participating partners: DAFF, EMU, CRI, SU, RMCA

Tasks:
1.1. administrative and financial project management. Communicate between STDF, the funding agency or agencies, and the different partners involved regarding necessary administrative procedures, including contractual issues. Drafting and updating consortium agreement, including Intellectual Property Rights (IPR) issues. Follow up on proper reporting and accounting by the different partner to the main implementing organisation. Coordination of payments and distribution of finances, and collation of financial statements. Ensuring gender equality within the project.

1.2. technical project management. Monitoring of the progress of individual work packages in terms of production of deliverables and key indicators, according to the logical framework, and coordination of activities between Work Package Leaders. Monitoring project risks. Collation of deliverables and milestone reports.

WP2: Establishment of PFA areas
Objective: To establish PFA areas according to standards set out in ISPMs 4 & 26.
WP leaders: DAFF (South Africa) & EMU (Mozambique)
Participating partners: ARC-TSC, CRI, SU, RMCA, contracted partners for monitoring activities (FruitFly Africa and Crop Watch)

Tasks:
2.1. Characterize PFA for (1) the Oriental fruit fly in South Africa and (2) the melon fly in Mozambique and South Africa. The Oriental fruit fly is currently declared present in the north and eastern parts of South Africa (fig. 5) and the south coast of KwaZulu-Natal Province. The pest is considered absent in other parts of the country. Some outbreaks were reported in the Western and Northern Cape Provinces between February and May 2018. In August 2013, the melon fly was reported in northern parts of Mozambique (fig. 4).

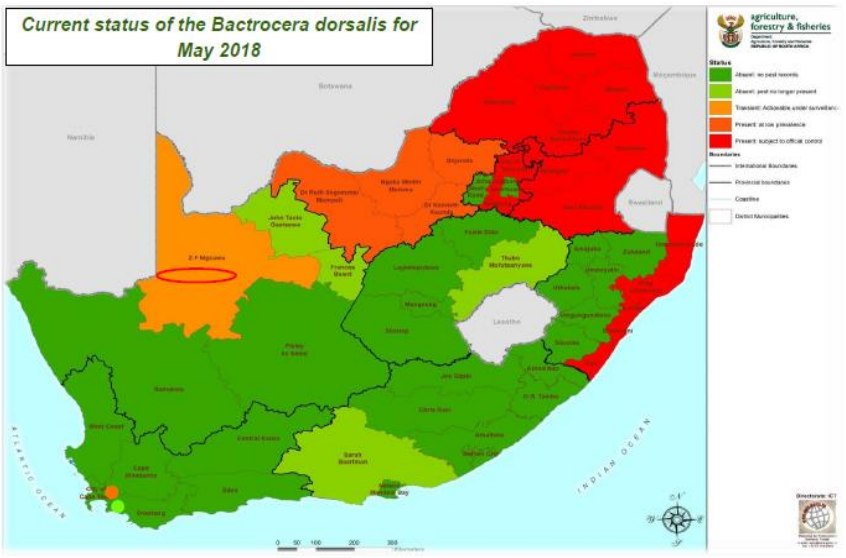

Fig. 5: detection and status of *B. dorsalis* in South Africa (situation 2018). Source NPPOZA.

The pest is considered absent in other parts of Mozambique. For both fruit fly pest species, their distribution within and adjacent to proposed PFAs will be determined. The commercial fruit production areas suitable for establishment of PFA and potential pest entry points will be identified. Selection of sites (list appendix 8) will be largely based on main fruit production areas in combination with the most vulnerable areas based on ecological niche models (figs. 6,7).

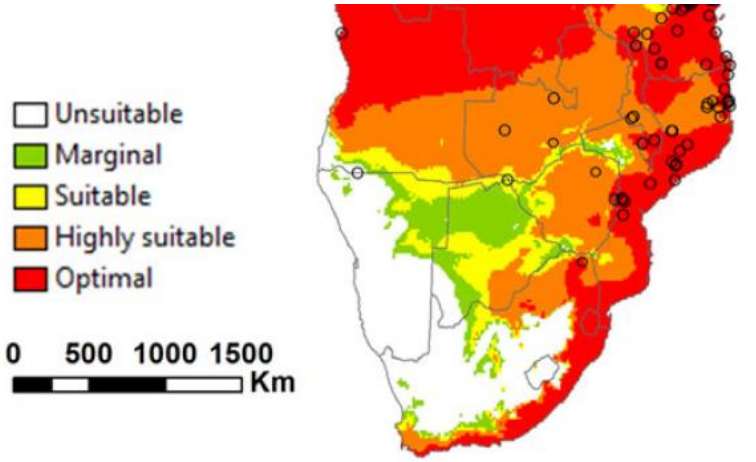

Fig. 6: projected climate suitability for *B. dorsalis*, using CLIMEX EI (occurrence data as open circles; from[18]).

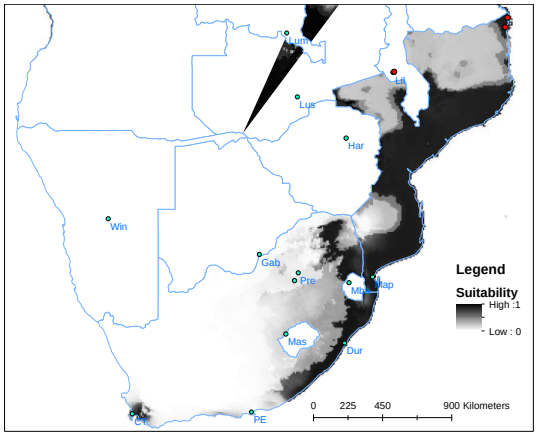

Fig. 7: projected climate suitability for *Z. cucurbitae* using MaxEnt (occurrence data: red dots; major cities: green dots; Robertson et al., unpublished data).

2.2. Establish PFA and associated buffer zones for the Oriental fruit fly in South Africa and the melon fly in both South Africa and Mozambique. Trapping points will be selected in identified proposed PFAs, based upon the results of the characterization under task 2.1. In order to determine the distribution of the pests within and adjacent PFAs, surveying activities will be first carried out for 12 consecutive months, using specific traps and lures in order to confirm absence of pest within proposed PFAs and in order to identify buffer zones. Traps will be monitored on a monthly basis and trapping results will be entered in centralized databased developed under WP5. An action plan is already available for the Oriental fruit fly in South Africa. An action plan will be developed for the melon fly as a roll out plan following detection of the pest in the PFAs.

2.3. Report of PFA to trading partners. Results of the trapping data during the one year survey period, and other compliances with ISPMs 4 and 26 will be included in an official report by the respective NPPO's to be presented to trading partners

WP3: ALPP thresholds

Objective: To define ALPP thresholds for citrus, selected subtropical fruit (litchi, avocado) and pome fruit (apples & pears) in accordance with trading partners' requirements
WP Leader: CRI
Participating partners: EMU, ARC-TSC, SU, ARC-I/N

Tasks:
3.1 Collate historical information (past 2 years) from different fruit production regions/farms on (1) fruit fly catches across the season (2) rejections at packhouses for the above selected fruit types (3) fruit fly interceptions on the selected fruit at markets not requiring post-harvest disinfestation treatments.

3.2. Relate new fruit fly trapping data (using specified traps and attractants at specified trap density) in selected fruit production areas with (1) field infestation of fruit at picking ripeness, (2) fruit from the selected areas which are rejected due to fruit flies during packing and sorting, and (3) fruit from the selected areas which are rejected by inspectors at packhouses.

3.3. Establish threshold level of specific fruit fly pest species on the selected fruit commodities by estimating risk of fruit fly infestation at different trapping levels based on results from 3.1 and 3.2.

WP4: ALPP areas

Objective: To characterize and establish model fruit fly ALPP areas, according to standards set out in Annexure I of ISPM 35.
WP leader: DAFF (South Africa) & EMU (Mozambique)
Participating partners: CRI, SU, ARC-TSC,

Tasks:
4.1. Propose model ALPP fruit production areas for Oriental fruit fly in Mozambique and South Africa, and Medfly in South Africa based on historical records (list appendix 8). Fruit types selected will be

the same as those evaluated in WP3. Surveying activities, using specific traps and lures in specific trap deployment methods will be conducted in the proposed ALPP areas for 12 consecutive months. Surveillance data will be compared with thresholds set under WP3 and areas of ALPP established with associated buffer zones. Surveillance data will be entered in centralized database developed under WP5.

4.2 Maintain low numbers of target fruit flies by applying specific population control measures in proposed ALPPs. Phytosanitary measures are developed and regulatory actions implemented. Establish ALPPs via official declaration by countries of proposed ALPPs which qualifies.

4.3. Establish a general corrective action plan in an ALPP for *B. dorsalis* and *C. capitata* as per Annex 1 of ISPM 35 which will include a flow chart of response and actions, delimiting surveys and recommendations on control measures.

4.4. Validate operational plan to maintain ALPPs for *B. dorsalis* and *C. capitata* in South Africa and Mozambique through case studies in selected regions under selected cropping systems.

WP5: identification and databasing services
Objective: To ensure that all records obtained through the characterization and establishment of PFA and ALPP for the target pests are properly identified and stored in a standardized manner, accessible to all parties concerned.
WP leader: SU
Participating partners: RMCA, subcontract to FruitFly Africa,ARC-SWC

Tasks:
5.1. Develop identification tools for all parties involved in monitoring surveys. A protocol for identification, and further confirmation and verification if required will be set up. Investigation into the use of automated identification of both adults and larvae, which will include assessing the practicality of using such methods, if found to be sufficiently accurate.

5.2. Set up a decision map and protocol to allow standardized rapid and unambiguous identification of any intercepted target pests or suspected other (invasive) pests.

5.3. Develop a relational database on a platform accessible through the internet, for all parties involved in monitoring surveys. A protocol for data access will be drafted, to ensure easy data entry but also confidentiality and protection of database, after wider consultation with potential additional subcontractors. Training in the use of this database will be organized.

5.4. Provide Training sessions to end-users of identification protocol (developed under 5.2.) and database platform (developed under 5.3.) are organized on a yearly basis.

5.5. Develop an online training course that can be offered to relevant technical staff involved in fruit exports to support rapid pre-identification, and that can provide ongoing training support after completion of the project.

WP6: Operational and Economic model
Objective: To develop an operational plan supported by an economic business model that will ensure the maintenance of the recognized PFA and ALPP
WP leader: SU
Participating partners: DAFF, EMU, CRI, ARC

Tasks:
6.1. Conduct a detailed financial cost benefit study for each area and per individual species *Bactrocera dorsalis* and *Zeugodacus curcubitae.*

6.2. Compile a series of whole farm financial models for the areas to be applied as tools for scenario development to assess the farm level financial implications of various pest free status situations.

6.3. Apply the cost benefit analysis and the multi-period whole farm models in combination for sensitivity analysis.

6.4. Identify cost efficient intervention strategies to negate the loss of status by multidisciplinary design techniques. This will aim to develop operational plans for maintenance of ALPPs for Oriental fruit fly in South Africa and Mozambique and operational plans for maintenance of ALPPs for Medfly in South Africa.

10. Environmental-related issues

Fruit fly pests in many fruit production areas of South Africa and Mozambique are mostly controlled by attract and kill methods which include the use of toxicants. These attract and kill methods are deployed regularly throughout fruiting season. In some fruit production regions in the Western Cape Province of South Africa, the species specific Sterile Insect Technique (SIT) is principally used for control of Medfly. In those areas under SIT, the use of insecticides is limited. Establishment of new fruit fly pests in an area would automatically increase the use of insecticides. For instance, in the north and north eastern areas of South Africa where the Oriental fruit fly is present, fruit growers have to include an additional attract and kill technique to deal more effectively with this pest. Areas free of the Oriental fruit fly and melon fly would not necessitate the regular use of additional attract and kill techniques for these pests. The limited use of insecticides would reduce negative environmental and health impacts. Additionally, invasive fruit flies pose a risk to the local biodiversity of the newly introduced area, as invasive pests often are able to out-compete local species, with added potential negative impacts on the healthy functioning of the agro-ecosystem.

ALPP for targeted fruit fly pests will be incorporated in a systems approach to mitigate fruit fly risks in fruit commodities. In a systems approach, integrated pre- harvest control techniques which would include localised attract and kill techniques, orchard sanitation and biological control as well as non-insecticidal post-harvest treatments will be used. Maintenance of low fruit fly pest levels would imply less frequent application of insecticides.

Surveillance activities are based on the use of specific attractants combined with a killing agent. However, these are confined in specific trapping devices (i.e. not exposed to environment), specific (i.e. do not kill non-target organisms) and can be deployed with organic killing agents.

11. Risks

A risk analysis was conducted by the consortium partners (see table in appendix 9). The main risks are further elaborated upon below.

<u>Risks to project goal: Establish and develop a framework for maintenance of fruit fly free areas and of areas of low fruit fly prevalence</u>

The spread of the two targeted invasive fruit fly pests: Oriental fruit fly and melon fly might be too widespread in South Africa and Mozambique respectively by the start of the project to enable entire provinces in each country to be declared free of these pests.

The actions taken to mitigate these risks are to focus on establishment of specific areas which were provisionally demarcated during the second workshop, based upon available information at this present moment. Further developments in the demarcated areas during the forthcoming months will be carefully monitored.

The recognition of fruit fly free areas and areas of low fruit fly prevalence would subsequently constitute an agreement between exporting and importing countries. Whilst this project will focus on establishment and maintenance of these areas based on scientific principles, the acceptance thereof by the importing countries would be beyond the control of this project. The actions taken to manage such risks are the involvement of the National Plant Protection Organisations (NPPOs) of both South Africa and Mozambique which are direct trading partners for certain fruit commodities. This would build a precedence in the international trade and could provide strong support to the systems developed.

There are currently several pests and diseases that could result in market access restrictions, other than fruit flies, in the southern African region, notably false codling moth *Thaumatotibia leucotreta*

and Citrus black spot for citrus fruit. The risk is that these other pests are not automatically controlled through establishment of PFA's or ALPP's against fruit flies, and that markets are therefore lost regardless of these efforts. The project will, however, aim to mitigate this risk by trying to include as many factors as possible to include such quarantine pests. For example, surveillance activities in the Western Cape already include false codling moth together with fruit fly surveillance, as an additional benefit to growers in order to optimise resources. Furthermore, once regional management programmes are established and operational, other phytosanitary aspects can be dealt with more efficiently within the integrated programme.

Risks to surveys for characterisation and establishment of PFAs and ALPPs

The surveys proposed would entail setting and servicing of intensive trapping networks in both South Africa and Mozambique and would require a high number of trained personnel in field activities and in identification. The partners in this proposal would not have the required time and sufficient personnel for fully undertaking these surveys.

The actions taken to manage these risks are the sub-contracting of these activities by the NPPOs of both countries to existing pest monitoring private services who are already operating in the two regions.

Risks to models developed for PFAs and ALPPs

The models developed for PFAs and ALPPs would need to be endorsed internationally for recognition in international trade.

Since the project preparation grant the International Atomic Energy Agency (IAEA), who was previously involved in setting up international fruit fly trapping guidelines, has been made aware of this project. Models developed through the course of this project will be discussed with the relevant authorities at IAEA before being finalised.

12. Sustainability

Two of the partners from South Africa and Mozambique in the proposed project, respectively DAFF and DSV, are the regulatory bodies in plant health in South Africa and Mozambique. This implies that areas established as fruit fly free and low fruit fly prevalence in both countries would be recognised by the exporting countries (South Africa and Mozambique), and validated by importing countries in fruit trade between South Africa and Mozambique. Similarly, models for maintenance of these fruit fly free areas and areas of low fruit fly prevalence would be adopted by DAFF and DSV and sustained institutionally in the longer-term.

The project has so far received full support of fruit growers associations in both South Africa and Mozambique. These industries understand fully the problem and are already facing the implications of the impact that these target pest species have on their production, profits and market access. They are factually already providing financial and in-kind input through different channels as outlined earlier under points 5 (public-private cooperation) and 6 (ownership and stakeholder commitment) which are contributing to the project (cf budget). During the project term, the foundation work for establishment and maintenance of fruit fly free areas and areas of low fruit fly prevalence would be laid. The project also aims to develop a business model and operational plant to maintain recognized PFAs and ALPPs (cf WP6). In order to address financial sustainability of the project in the longer term, workshops with growers and grower associations on the aspects and obligations involved in establishment of PFA and ALPP, and the resulting benefits would be organised. In general it aims as acting as a catalyst for a sustainable commitment by the private industry, which will largely depend on the successful implementation of the project's results and their immediate and visible impact on the industry.

III. BUDGET

13. Estimated budget

See appendix 3

14. Cost-effectiveness

The market access that South Africa currently experiences is seen as a benefit amounting to US$ 1 602 657 390.00, while the total costs amount to US$ 284 293 724.00, resulting in a benefit-cost ratio of 5.64. For the calculation, the costs included eradication and surveillance costs, pre- and post-harvest treatment costs for deciduous fruit, table grapes, citrus and subtropical fruits, levies paid to industries bodies and to PPECB (Perishable Produce Export Certification Agency), multiplier effects and certification cost for special markets. For this cost benefit analysis, the loss of the sector was calculated if the current special markets are closed, because *B. dorsalis* has become established, known as the multiplier effect. This was the initial cost benefit analysis, indicating a positive outcome, but a full cost benefit analysis will aim to include more refined costs, such as research costs, social impacts, cost of creating awareness etc. A full reporting of the cost benefit analysis can be found in appendix 7.

IV. PROJECT IMPLEMENTATION & MANAGEMENT

15. Implementing organization

Initially it was suggested to have DAFF partner acting as implementing organisation. However, the administrative and financial regulations in this government organisation are considered to heavy and complicated in order to allow a smooth administrative and financial co-ordination of the project's planned activities (similar to the reasoning regarding the PPG and to have these funds administered by the RMCA partner). It was, therefore, decided that the ARC partner should take this role.

The Agricultural Research Council is a public entity established under the Agricultural Research Act, 1990 (Act No. 86 of 1990, as amended). It is a schedule 3A public entity in terms of the Public Finance Management Act, 1999 (Act No. 1 of 1999, as amended). As such it acts as the research branch of the DAFF. In terms of the Agricultural Research Act, the objectives of the Agricultural Research Council are to conduct research, drive research and development, drive technology development and the transfer of information in order to:

- promote sustainability and equitable economic participation in the agricultural sector;
- promote agricultural development and growth in related industries;
- facilitate sector skills development and knowledge management;
- facilitate and ensure natural conservation;
- promote national food security; and
- contribute to better quality of life.

In this capacity ARC has been involved already in longstanding activities regarding fruit fly pest control. During 2014/15 the ARC Council established an External Institutional Review for the period 2007 to 2014. The Institutional Review ascertained that the ARC continues to meet its mandate, mission and objectives as outlined in the Agriculture Research Act, 1990 (Act no. 86 of 1990, as amended). It was noted that for the review period, the ARC has stabilized and strengthened governance and executive management. The ARC has established a track record of impact with smallholder agriculture. Partnerships with commodity organizations, provincial government departments and international organizations have improved, resulting in several key success stories with impact in areas such as honeybush, indigenous chickens, irrigation pedal power, sweet potatoes and others[25].

The ARC's internal financial controls comply with the Public Finance Management Act, 1999 (Act no. 1 of 1999, as amended) and the organisation's Enterprise Risk Management Framework. The ARC is internally audited and the Auditor General provides an external audit each financial year[25].

16. Project management

The project manager who will be responsible for general management, will be ARC-TSC, South Africa (Dr Tertia Grove). EMU (Prof Domingos Cugala) will assist ARC-TSC in project management and implementation in Mozambique. The role of both ARC-TSC and EMU will be to develop operating plans, agreements, financial arrangements, and general coordination and monitoring of the activities. They will also follow up with the different WP leaders for reporting, and will report directly to STDF.

In addition, a Steering Committee, comprising senior officers of the participating consortium partners will be composed with the project manager as chairperson and the assistant as vice-chairperson. The Steering Committee will ensure that all tasks and deliverables, as outlined in the project are respectively conducted and met. Members of the steering committee will also act as WP leaders ensuring smooth execution of the projects activities. The Steering Committee will meet in person once a year, and have intermediate skype conference meetings (i.e. six months after meeting). Decisions by the Steering Committee will be by consensus. In case of failure of reaching a consensus, the project manager will take a decision.

A Technical Advisory Committee will be composed of scientific specialists, representatives of the fruit growing industry and other stakeholders. The project manager and/or assistant project manager will partake in the meetings of the Technical Advisory Committee as representatives of the project's consortium. The Technical Advisory Committee will give advice on the design of the activities and on technical aspects. Steering Committee and Technical Advisory Committees will jointly meet at the start of the project (in Year 1 and 2).

V. REPORTING, MONITORING & EVALUATION

17. Project reporting

The project manager will coordinate timely delivery of short six-monthly progress reports to STDF. The first of these progress reports will be the inception report, as a result of kick-off meeting. These progress reports will summarize activities conducted in the previous six months, i.e. new achievements, deliverables attained, adjustments, etc. to allow monitoring of the activities in accordance with the scheduled planning.

Yearly the progress report will be supplemented with minutes of the Steering Committee and Technical Advisory Committee meetings and evaluation of points raised by these respective committees.

At the end of the project, an end-of-project assessment will be conducted by an independent evaluator selected by the project manager or STDF. This assessment will be incorporated in the final report to be submitted to STDF.

18. Monitoring and evaluation, including performance indicators

Each WP consists of specific tasks with specified milestones (see work plan in Appendix 2). In each progress report (six-monthly and annual), the milestones achieved of the planned tasks for the period will be reported. In cases where milestones were not achieved, reasons will be provided and a new timeline for the deliverables will have to be proposed.

19. Dissemination of the projects results

The results of the project will be disseminated in annual reports and a workshop at the end of the project term with primary stakeholders in both countries. At a regional level, the results will be disseminated to organisations such as Southern African Development Community (SADC). Internationally, results will be disseminated to international agencies dealing with SPS or related issues such IAEA and IPPC.

The results will also be disseminated to the growers' associations, main fruit producers in South Africa, Mozambique and neighbouring countries. A synthesis brief will be offered to the different

media channels (written press, radio and television, social media) for publication or further circulation.

It is envisaged that the results of the project could act as a model and lead to replications of development of PFA or ALPP for target fruit flies in other, neighbouring, countries or within South Africa and Mozambique for other regulated pests and diseases.

ATTACHMENTS

Appendix 1: Logical framework

Appendix 2: Work Plan

Appendix 3: Project Budget

Appendix 4: Letters of support from organizations that support the project request

Appendix 5: Written consent ARC to implement the project

Appendix 6: List of primary and secondary stakeholders

Appendix 7: Cost/Benefit Analysis report

Appendix 8: Proposed list of areas to be considered as PFA and ALPP

Appendix 9: Project risk analysis

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