



## The SystemPLUS Research Programme

### **Diversification of Agricultural Systems Using Underutilised Crops and Cropping Systems**

SystemPLUS examines the environmental, productivity, resource use and socio-economic potential for the transition from mono-cropping to mixed cropping, initially using some of the species selected for other CFFRC programmes. SystemPLUS quantifies agro-ecological processes at the cropping and farming system scale to examine the use of natural resource, sustainability and economics of diversifying beyond the monocultures that now dominate global agriculture and its effect on livelihoods.

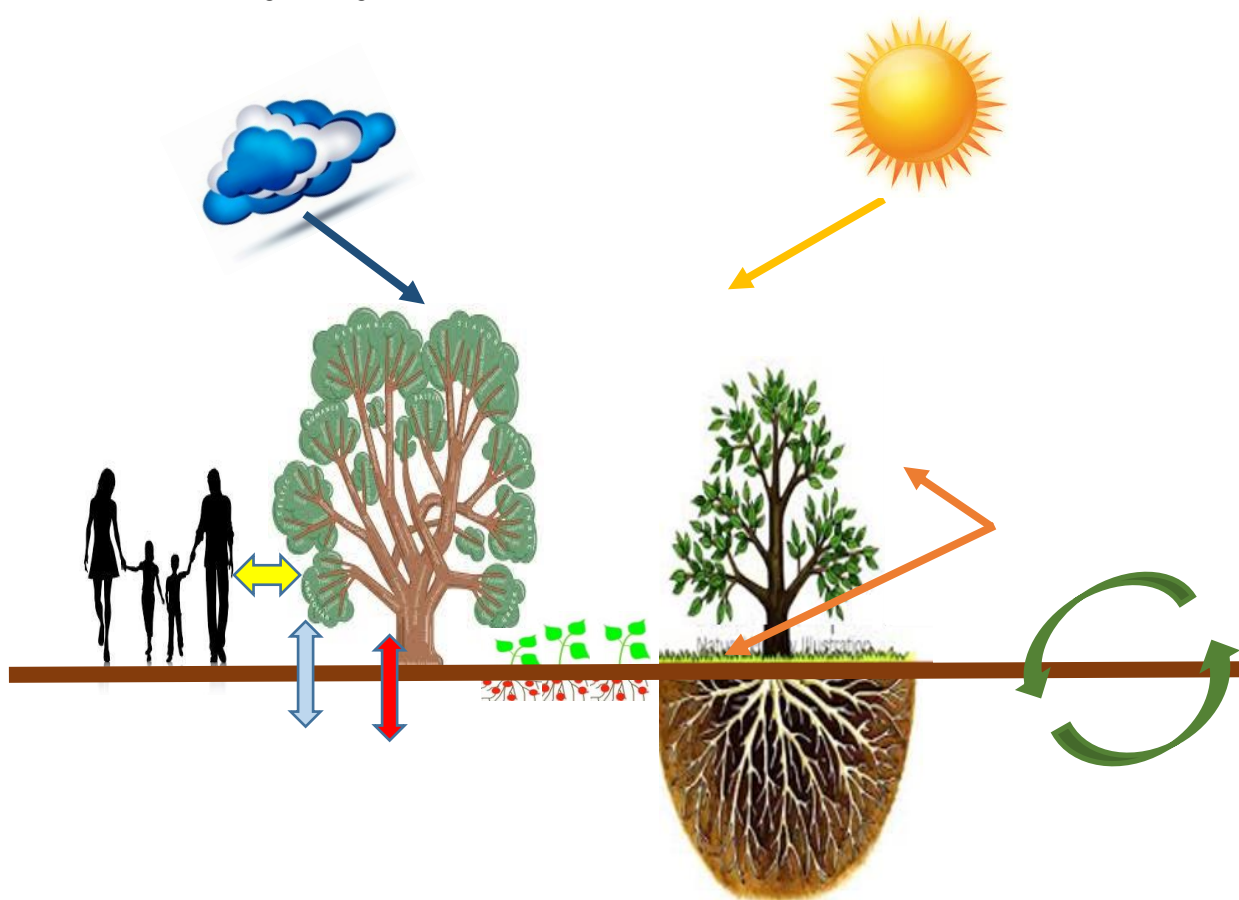


Fig. 1. A graphic representation of SystemPLUS.

### **Beneficiaries**

The principal beneficiaries are rural communities as SystemPLUS will support the dissemination of agroecological farming techniques. Farmers will benefit from improved crop choice, soil management, and water catchment management. Local organizations will be strengthened by the focus on viable technologies to manage the process of local resources and knowledge, but integrating useful new practices. National natural resource managers will benefit from alternative integrated useful practices and interventions by communities.

## **Outline and Context**

SystemPLUS quantifies agroecological processes at the crop, farming system and watershed scales. In doing so, it will analyse changes in the use of natural resources in order to improve sustainability and optimise the economics of crop diversification beyond the dominant monocultures. The proposed transitions will require assessment in both the biological and human spheres.

## **Programme Design**

To structure the research programmes CFFRC uses an analytical and project design process called the Logical Framework Approach. In the context of each research programme, the LFA provides a means to identify where a particular development gap or deficiency exists and thence devise a Problem Statement that encapsulates the challenge to be addressed. The Problem Statement is converted to an Objective. This represents the future solution on which the research programme is focussed and the basis to identify research and other programme deliverables, together with the requisite inputs, that are necessary to attain the research programme's Outcome.

## **Problem Statement**

*Alternative sustainable agriculture systems, incorporating underutilised crops, are insufficient to sustain human consumption.*

The problem statement is linked to:

1. Many unanswered questions existing about interactions between components of ecosystems or the soil-plant-atmosphere system.
2. Little is known about the transitions that take place during the process of conversion from a mono-culture sole cropping system to a multi-cropping integrated farming system.
3. Several unknown factors in the relationships between agro-ecosystems and influence on local communities, including changes that could benefit them as ecosystem services.

## **Outcome**

The SystemPLUS Research Programme characterises and evaluates agro-ecological, agro-meteorological and community aspects of potentially complex, multispecies farming production systems. SystemPLUS is focused on the benefits of multispecies system interaction within multicropping systems and the associated promotion of sustainable economic growth and development.

## **Research Clusters**

The SystemPLUS Research Programme will address a diverse range of issues which are grouped within the following research clusters: -

## Research Clusters and Projects

Table 1:- Research clusters specific projects within the SystemPLUS programme

Cropping System	Farming System	Ecosystems	Methodologies
<p>Cluster focus: Advice on productive intercropping systems. Improvement of existing crop models to include calibrated modules for underutilised crops. Generic modules to expand crop models to include multi-cropping.</p>	<p>Cluster focus: Handbook on assessment &amp; development of underutilised crop users &amp; products. Whole farm model showing importance of minor crops in farming systems for nutritional, economic &amp; social wellbeing.</p>	<p>Cluster focus: Characterisation of atmosphere / soil / water changes during transition to multi-cropping. Useful indices to describe potential of underutilised crops as ecosystem services</p>	<p>Cluster focus: Successful application of classic methodologies applied to underutilised crop. Scientific publications utilising the state of the art information. Efficient and effective research across the value chain.</p>
<ul style="list-style-type: none"> <li>• Evaluate a range of underutilised crops introduced during transition from mono-cropping to intercropping including underutilised crops</li> <li>• Measure &amp; model interactions between crops in intercropping or integrated systems with underutilised crops by assessing resource use efficiencies</li> <li>• Optimisation of strategies for selection and introduction of a range of underutilised species</li> <li>• Monitoring of process of transition from monocropping plantation species (e.g. tea) to integration with underutilised species</li> <li>• Preliminary investigation of alternative methods and scales of modelling cropping systems</li> <li>• Investigate, by detailed field experiments, other exemplar underutilised crops</li> </ul>	<ul style="list-style-type: none"> <li>• Conduct surveys &amp; collect detailed information about role and value of underutilised crops in people's lives on each continent</li> <li>• Assess value, worth and contribution made by underutilised crops within farming systems</li> <li>• Design appropriate applications to promote the use of products from underutilised crops</li> <li>• Use 'agent-based' modelling to describe the range of influences on a typical small-scale farming system, so as to predict the effect of changes</li> <li>• Test, monitor &amp; evaluate effect of the introduction of underutilised crops into farming systems dominated by major crops</li> <li>• Conduct a series of workshops to plan and develop, as a mental exercise, the relationships between the various components of farming systems.</li> </ul>	<ul style="list-style-type: none"> <li>• Use micrometeorological monitoring and models to quantify crop-atmosphere interactions during transitions from mono-cropping to multi-cropping / intercropping</li> <li>• Compare the influence of a range of underutilised crops on the state of the environment</li> <li>• Design and evaluate indices to monitor and predict the effect of underutilised cropping systems on ecosystem services</li> <li>• Develop and test potential indices for assessing ecosystem stability &amp; sustainability</li> </ul>	<ul style="list-style-type: none"> <li>• Develop and compare remote sensing with land-based methods to monitor changes resulting from transition from mono-cropping to multi-cropping including underutilised crops</li> <li>• Conduct a series of high level think tank workshops with selected experts programme, as a mental exercise</li> <li>• Use experiences in CFFRC programmes to develop &amp; document progress in natural-social science interactions</li> <li>• Develop and use micromet measurement techniques and models to describe crop-atmosphere interactions</li> <li>• Develop logical framework for evaluation of alternative methods that could be used in a specific application</li> </ul>

## Research Outputs

Among the research outputs that may potentially be attained by the SystemPLUS Research Programme are:

- Example systems for underutilise crops nutrients and economics aspects
- Operational crop model calibrated for underutilise crops
- Useful description indices at catchment level
- Handbook describes typical methods used in system analysis.

## Research Partners

Potential research partners include organisations and their members that use or are concerned with agroecological evaluation of complex cropping system. The proposed categories of the partners are

- Centre for Agricultural research and Development in Southern Africa (CCARDESA)
- Government agencies – Ministries of Environment, Meteorology, Agriculture and Forestry
- Research institutes –Agriculture, Ecosystem, Forest & Biodiversity Research and Development Institutes,
- International agencies - NGO s and UN agencies
- Rural communities – Land Development & Rehabilitation Institutes.
- Universities

## Milestones

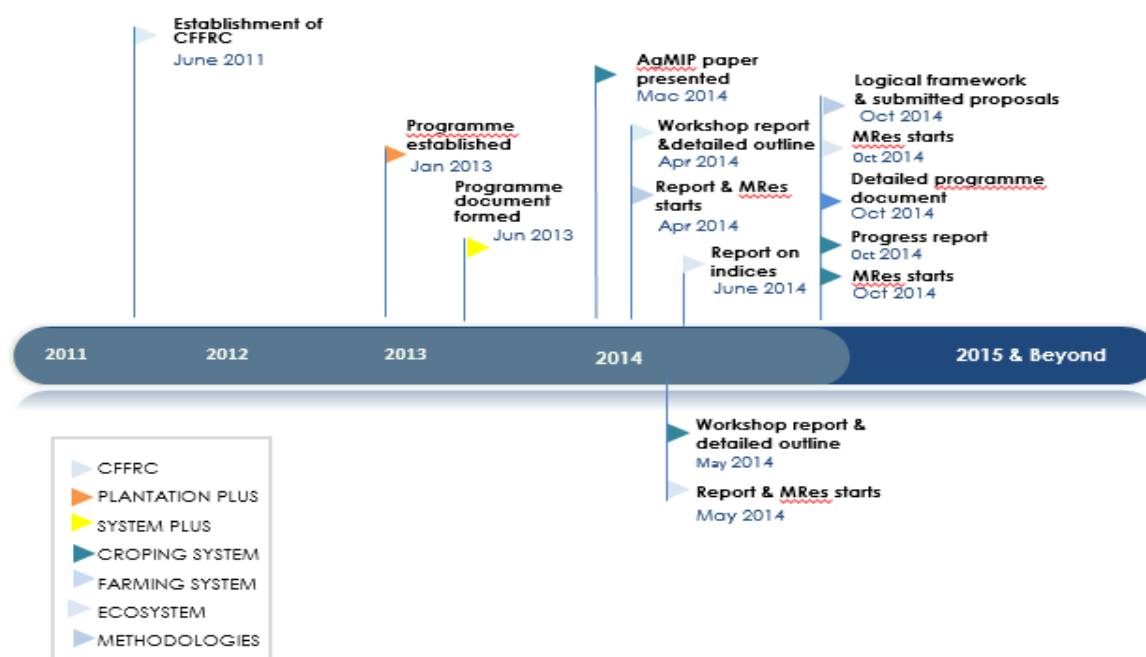


Fig. 2. Past and future milestones as indicated by research specific projects

## Programme Contact

Ms SivaSangari  
 Programme Support Manager, SystemPLUS  
 Crops for the Future Research Centre (CFFRC)  
 Level 2 Block B  
 The University of Nottingham Malaysia Campus  
 Jalan Broga, 43500 Semenyih  
 Malaysia

General line: +60 3 8924 8799  
 Fax: +60 3 8924 8798  
 Email: [sangari@cffresearch.org](mailto:sangari@cffresearch.org)  
 Website: [www.cffresearch.org](http://www.cffresearch.org)

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