1994-2014 20TH ANNIVERSARY

ASARECA
Transforming Agriculture for Improved Livelihoods

Celebrating the impacts

Annual Report 2013

The Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA) is a not-for-profit inter-governmental sub-regional organization. ASARECA comprises 11 member countries: Burundi, the Democratic Republic of Congo, Eritrea, Ethiopia, Kenya, Madagascar, Rwanda, South Sudan, Sudan, Tanzania and Uganda.

Vision

Regional leader in agricultural research and development for improved livelihoods in Eastern and Central Africa.

Mission

Enhance regional collective action in agricultural research for development, extension and agricultural training and education to promote economic growth, fight poverty, eradicate hunger and enhance sustainable use of resources in Eastern and Central Africa.

ASARECA brings together scientists from the national agricultural research institutions of the 11 member countries to work collectively with farmers, regional and international research, extension, and training organizations; public and private sector actors; NGOs; the regional economic communities and development agencies to generate, share and promote knowledge and innovations to assist smallholder farmers to practice productive and profitable agriculture.

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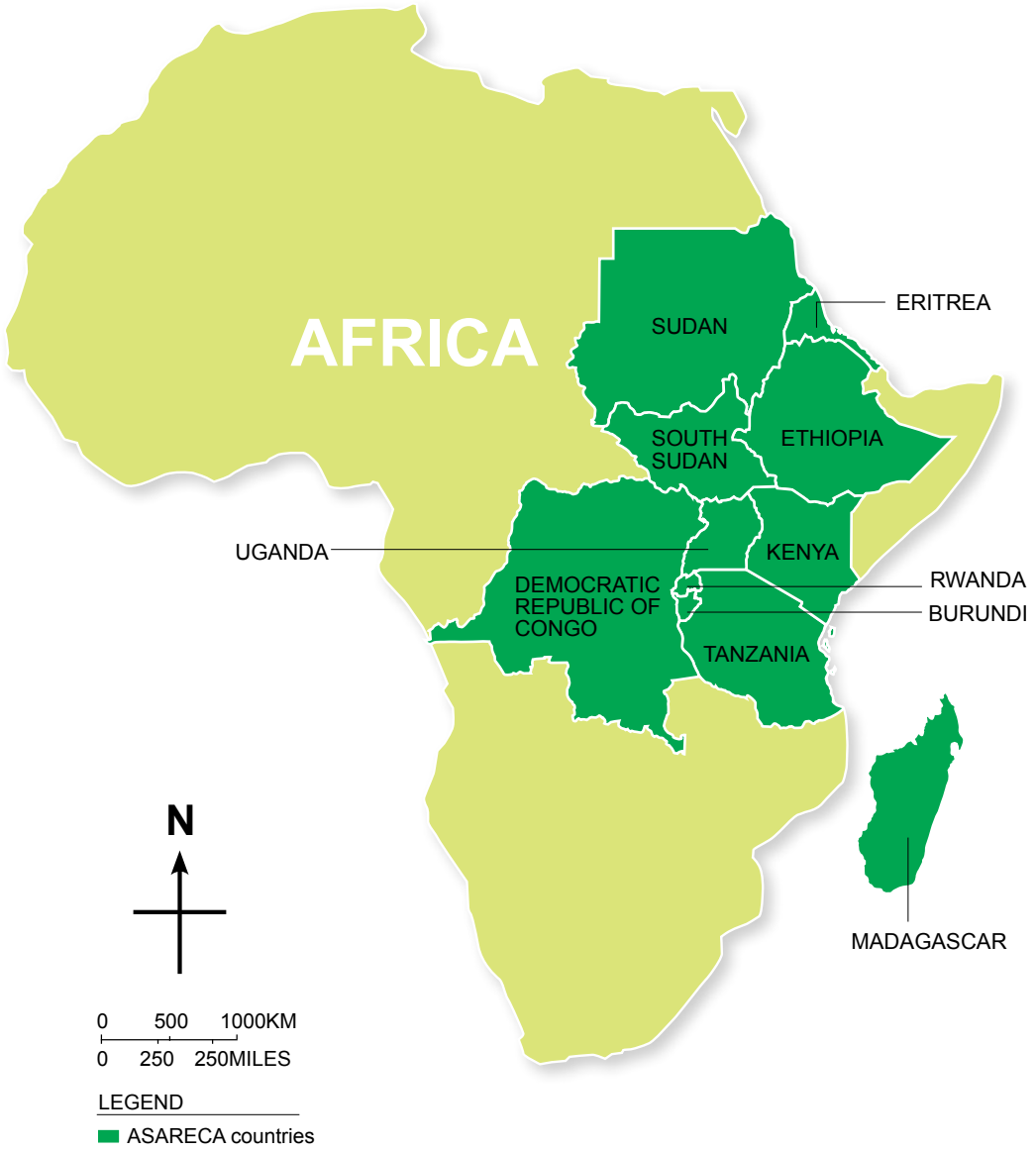


Annual Report 2013

Celebrating the impacts

Resounding achievements for millions of our people

Dr Fidelis Angelo Myaka, Chairman Board of Directors, ASARECA

On behalf of the 11 ASARECA member states, I would like to thank the ASARECA family for successfully implementing the first five-year Operation Plan (OP I) which has been running from 2008 to 2013. There is no doubt ASARECA scored resounding achievements in its pursuit to get millions of our farmers out of poverty and hunger. As highlighted in the Executive Director's statement, by generating a total of 409 agricultural innovations during the last five years, ASARECA answered many unsatisfied needs of farmers in Eastern and Central Africa.

Just like the 1st ASARECA General Assembly (Entebbe, Uganda 2011), the 2nd ASARECA General Assembly and Scientific Conference held in the Burundian Capital, Bujumbura from December 9-13,2013, demonstrated the increasing relevance of collective action to manage agricultural challenges of a regional nature. The over 600 delegates at the General Assembly acknowledged ASARECA's critical role in transforming agriculture in the sub-region and extolled the achievements.

ASARECA finalized preparation of its Second Operation Plan (OP2) in 2013. Drawing from invaluable input of our deep stakeholder base, we put together a document built upon the lessons learned in implementing OP1 and integrating the views and demands of stakeholders along the agricultural value chains. The OP2 document is a statement of how ASARECA intends to carry out its business from 2014 to 2018. As well as lessons learned.

1.8M
Number of households that ASARECA targeted to reach with innovations, technologies and practices

OP2 recognises the prevailing challenges and opportunities in the agriculture sub-sector, the changing external and internal conditions, and fresh priorities.

Our top priority remains transforming agriculture into a viable market-oriented venture by focusing on access to markets for smallholder farmers, most of whom are women, and providing them with appropriate information on marketing forces and requirements such as quality, quantity and price. This, we anticipate, will draw more youth to agriculture. We will continue to catalyse cooperation among sub-regional stakeholders to make the best from brains and innovations on the continent.

Starting January 1, 2014, ASARECA initiatives will be organized around three themes: Natural Resources Management and Eco-systems Services; Markets, Market Linkages and Trade; and Sustainable Agriculture, Food Security and Nutrition. ASARECA has targeted to reach a minimum of 1.8 million households with innovations, technologies and management practices. This is projected to positively impact the livelihoods of 11 million individuals, 50% of whom are below poverty line.

On behalf of the Board of Directors, I would like to thank our Development Partners for unwaveringly supporting OP 1. In the same vein, I would also like to thank the Governments of the 11 member countries for supporting ASARECA through Annual membership contributions, pools of human resources and physical facilities.

Finally, I would like to thank ASARECA secretariat staff comprising a team of diverse and multi-disciplinary professionals, for exercising resilience over the last five years to ensure that the ASARECA promise is delivered.

Looking forward to working with you all in implementing OP 2.
Thank you

A big thank you to our development partners

Dr Fina Opio, Executive Director, ASARECA

In 2013, ASARECA ended implementation of the first Operational Plan (OP1), which ran from 2008 - 2013. We are proud of the agricultural innovations that resulted from our work during OP1. By the end of 2013, we had registered several achievements, thanks to the support that we received from different partners. On behalf of the ASARECA community, I would like, therefore, to acknowledge and thank the development partners who provided funds and technical assistance to ASARECA during OP1. The development partners are:

- The European Union (EU)
- The Department for International Development (DFID)
- The United States Agency for International Development (USAID)
- The Canadian International Development Agency (CIDA-CANADA)
- The Swedish International Development Agency (SIDA-Sweden)
- The International Development Research Center (IDRC)
- The African Development Bank
- The World Bank

As a result of the support, we have registered the following achievements:

A total of 409 different agricultural technologies, innovations and management practices (TIMPs) were either generated or improved to suit farmers' demands. In addition, 498 TIMPs were availed for uptake by targeted stakeholders, leading to significant benefits to the beneficiaries.

For example, through the adoption of labour-saving equipment such as ox-planters, ox-weeders, ox-rippers and threshers, farmers reported reductions in drudgery by up to 75% per acre.

Over 4,600 ha of land were dedicated to improved TIMPs, especially for the production and multiplication of quality pre-basic, basic and certified seeds of selected crops. As a result of this, over 800 metric tons of quality seed were produced and either sold or distributed to farmers for further multiplication. On the other hand, over 5,000 ha of highly degraded lands and watersheds were reclaimed, thereby providing targeted households with steady water supply for domestic and farm use.

ASARECA contributed to enabling policy environments through review of existing policies, laws, regulations and management practices. A total of 100 policies, laws, regulations and procedures were analysed, 46 were presented for legislation and dialogue, while 17 were approved by various legislative bodies including the EAC and COMESA parliaments.

422,172
Number of rural households that directly benefited from ASARECA-related support initiatives

A total of 422,176 rural households directly benefited from ASARECA-related support initiatives, and over 2.5 million individuals directly benefited from an assortment of ASARECA support initiatives. Furthermore, 270,000 farmers and other stakeholders have adopted new TIMPs generated and availed for uptake from project- related interventions. This led to an increase in net crop production value of US$73.4 million within the OP1 period.

Food security improved for beneficiary households over the OP1 period by 7% points, compared to an increase of 1% point for non-beneficiaries. Highly positive spill-over effects were noted for the projects, with an average pass-on rate to non-project farmers of 7 for each beneficiary household.

In addition, the implementation of the projects in OP1 led to significant generation of benefits to stakeholders, including provision of additional

income for farmers, processors, small-scale traders, and increased productivity of selected commodities. For example, average total crop revenue increased by 63% from US$272 to US$442 between 2008 and 2012 for beneficiaries (compared to only 5% for non-beneficiaries). Total livestock revenues also increased by 139% from US$157 to US$375 over the same period, compared to a fall of 21% for non-beneficiaries.

For this edition of the annual report, we are featuring selected successes of ASARECA work, recognizing that much of the progress we note in 2013 builds upon work that was started in the previous years of OP1 implementation. The stories in this report demonstrate how ASARECA research for development work impacts on the lives of people in Eastern and Central Africa.

409

Agricultural technologies, innovations and management practices (TIMPs) were either generated or improved to suit farmers' demands

800mt

Quality seed that was produced and either sold or distributed to farmers for further multiplication

2.5

million individuals directly benefited from ASARECA support

17

Number of policies, laws, regulations and procedures that were approved by various legislative bodies including the EAC and COMESA parliaments

422,172

Number of rural households that directly benefited from ASARECA-related support initiatives

Recognizing that much of the progress we note in 2013 builds upon work that was started in the previous years of OP1 implementation, this edition of the annual report features selected successes of ASARECA work over the last five years. The stories in this report demonstrate how ASARECA research for development work impacts on the lives of people in Eastern and Central Africa.

These children in Tanzania are happy because banana, their staple food is back in the daily menu

Getting banana production
back on track after BXW

With ASARECA support, several partners promoted proven and cost-effective measures to control Banana bacterial wilt outbreak that threatened banana production between 2005—2010 in Burundi, Kenya, Rwanda, Tanzania, the Democratic Republic of Congo and Uganda. Within the first six months of intervention, the proportion of farmers who controlled the disease increased from less than 5% to over 60%. Within 15 months, banana production recovered, shooting up to over 80% in some areas.

When BXW (Banana *Xanthomonas* Wilt), a devastating disease, ravaged countries in Eastern and Central Africa in early 2005 through to 2010, Mzee Koloneli from Ruhunga Ward in Tanzania, lost his entire crop. However, in early 2010, help arrived from ASARECA, working through the Agricultural and Rural Development Initiative (ARDI), an NGO in Tanzania.

Koloneli's Story

"The scientists told me that we had helped spread the disease through farm tools. They said the disease could be controlled using simple measures. I followed their advice by disinfecting my machetes, hoes, destroying sick plants and many other measures...then I replanted according to their recommendation," says Koloneli. Three years down the road, Koloneli sounded victorious. "It is as if nothing ever went wrong. I have regained and surpassed the harvest I was getting before the disease."

Koloneli shows off his new plantation after the intervention

Another farmer, Edwin Sarapion, also from Ruhunga Ward in Tanzania, has a related experience.

Sarapion's Story

"I was one of the 20 farmers who participated in the training offered by ARDI on how to produce clean banana seed using two techniques: macro-propagation and decapitation. In addition, the project provided me with construction materials worth Tsh 1,600,000 (about US$900) and technical expertise. I established one of the seven macro-propagation units that were supported by the ASARECA project in my location and I harvest over 2,000 plantlets annually which I sell to other farmers. Last year, I earned over US$1,000 from plantlets alone. I earn much more from banana sales and all my neighbours now have clean planting materials."

Serapion at his macro-propagation unit at Ruhanga in Tanzania

Koloneli and Sarapion are only two among millions of farmers in Eastern and Central Africa who today testify that they have weathered the storm of a disease that years ago threatened their existence. Banana and plantain are major sources of food and income for about 30 million people in Eastern and Central Africa. It is no doubt that immediate action was needed when BXW attacked. BXW causes premature ripening and rotting of banana, leading to massive reduction in yield and severe loss in income for the farmers.

ASARECA's first step was to mobilise the national agricultural research institutes in the region to deal with the disease as a trans-boundary problem. Scientists supported by ASARECA promoted proven and cost-effective measures to control the disease. This was done through the project, "Out-scaling BXW control in Eastern and Central Africa".

30
Number of secondary plants that can sprout after killing the primary plant

"We had to ensure that the spread of the disease was stopped in the participating countries of Burundi, Kenya, Rwanda, Tanzania, the Democratic Republic of Congo and Uganda," says Dr Ivan Rwomushana, the manager Staple Crops Programme of ASARECA. The scientists worked with local communities in the hotspots, creating awareness on how the disease spreads and how it could be stopped. They introduced control measures including disinfecting farming tools, destroying sick plants to remove the source of disease, cutting affected corms from the banana mat, and using forked sticks to remove the "male" bud of infected plants.

Uprooting five-to-six months old clean corms turned out to be the most effective procedure. The corms and their sheaths were removed up to the meristem. Killing the meristem (primary plant) encouraged secondary plants to sprout. Up to 30 plants could be obtained from each corm. As a result, the affected areas witnessed rapid multiplication of clean planting materials, leading to the revival of banana fields.

A woman in Kenya laments about the devastation caused by BXW

Apart from farmers, the project worked closely with community leaders and extension staff who enforced

New suckers sprout from the primary plant after decapitation.

agreed measures and standards to keep BXW away from the communities in a sustained way. Besides, farmers were sensitized about the banana value chain and how to benefit more from the chain.

By promoting participatory methods of work, ASARECA partners inspired the local communities in Ibale village, Muleba district, Tanzania to take charge of fighting BXW to ensure sustainability. According to Mr Jackson Martin, the chairperson of the BXW control committee in Ibale, over 155 households in the village received training from ASARECA teams on how to recognize and control the disease. Since then, local committees monitor the compliance of households to BXW control measures. "A household that is found defaulting on the measures is fined according to community by-laws and instructed to uproot the bananas," says Martin.

When combinations of control measures were used, the proportion of farmers who controlled the disease in the first six months increased from below 5% to over 60%. In 15 months, banana production recovered, shooting up to over 80% in some areas.

Banana production is also being revived in areas that are far from the actual project sites in Tanzania because

information and clean banana plantlets are readily available.

In Burundi, where BXW caused up to 92% crop loss and affected 72% of the banana farmers, ASARECA, working with ISABU, mobilised the communities to take the disease head-on. Using ASARECA's experience in developing and empowering farmer groups, farmers in Cibitoke, 58 Kms East of the capital, Bujumbura, were supported to form Cibitoke farmers group in March 2013. The group of 50 members was meant to rally the masses against BXW. They received training from ISABU on how to control the spread of BXW and regain banana production.

They drafted by-laws to guide control measures and monitor compliance. The group then started sensitising other farmers in the district on how to control BXW. "We provided information on methods like timely removal of male buds, removal of single infected plant from the mat, disinfecting farm tools and that has helped," says an excited farmer. As a result of these concerted efforts, farmers have reported a 72% increase in production from the disease peak levels.

In Rwanda, ASARECA working with the Rwanda Agricultural Board (RAB), mobilised communities in the two districts of Gisagara and Kayonza (covering 26 BXW hotspots), to control the disease. The communities were also supported to establish two mother gardens each of 1 ha with varieties such as Mpologoma, FHIA 17, FHIA 25 and Injagi to provide a source of clean planting materials. Through these initiatives, BXW prevalence was brought down from over 90% to less than 5%.

Besides work done in Burundi, Tanzania and Rwanda, the project established eight macro-propagation units in four sites in DRC, in addition to mother gardens and demonstration plots in Kayonza and Gisagara districts. The units initially produced 8,000 clean banana plantlets for distribution to farmers. In Kenya, six hardening nurseries, 10 demonstration plots and 10 macro-propagation units were installed. In Uganda, eight mother gardens were established in all BXW hotspots.

80%

The percentage increase in banana production after using BXW control measures

Decapitation, one of the methods used to increase production of healthy suckers

Burundi farmer shows off numerous bean pods resulting from staking and use of improved varieteis

Giving new meaning to beans for farmers in Burundi, Rwanda

Farmers in three countries are realizing increased incomes and better nutrition as a result of adopting climbing beans innovations such as intercropping the beans with maize as stakes; and mono-cropping beans using string stakes. Farmers who intercropped climbing beans with maize got average economic returns of US$ 2,030 per season, while those who planted only beans (and used string stakes) got economic returns of US$ 1,300.

Mr Augustine Shiragahinda is farmer in Musange district, Rwanda. Augustine has tripled his bean production and sales which transformed his life and that of his family. He has become a role model for his community. He is active in promoting innovations and practices for climbing beans to farmers in his community and beyond.

Mr Augustine Shiragahinda from Musange district, Rwanda tripled his bean production and sales

Augustine's story

"I had given up on planting climbing beans because the cost of the woody stakes was high and the stakes were scarce. In addition, I did not have access to good quality climbing bean varieties. In 2009, I became a contract farmer for the climbing bean project. I provided land for on-farm trials, a demonstration plot and a farmer field school. In return, I received advice on various aspects of planting beans. These days I harvest over 3.5 t/ha because I use improved high-yielding seed. I also use organic manure and I plant in rows. I now use sisal strings for staking, which is a big saving compared to when we were using woody stakes. With the proceeds from beans, I have constructed a house and installed electricity in it. I bought a cow, which gives me manure and milk."

The value of the new knowledge is not lost to the elderly. Ms Theresie Mukandamutsa, 74, of Irebero, Rwanda explains, "All my life, I have planted beans mixed with maize, potato and pumpkin in one garden with no attention to order. But with the new practices that we have been taught, we now plant beans in an organized way. We make furrows and then plant the bean seed in a pattern and our harvest is now much better."

Beans are very important to the people in Burundi, the Democratic Republic of Congo (DRC) and Rwanda. Over the years, the quantity and quality of beans produced by farmers has reduced, leading to increased malnutrition, especially in children and the elderly.

Of the three types of beans; bush beans, semi-climbing beans and climbing beans, the latter outyields the others by three times.

$1300

Income received by farmers who adopted the sisal/string innovation for staking beans

However, farmers have continued to grow poorly performing mixed bush bean varieties. This is because climbing beans require vertical support (staking) as they grow. Woody sticks, which are commonly used for staking, are costly and scarce because households commonly use them as fuel. Farmers believe that beans are a subsistence crop not worth investing in, and so they are reluctant to pay attention to the quality of the seeds they plant. This is largely due to poor market information and inadequate extension services.

It is against this backdrop that ASARECA started the project "Intensification of climbing bean-based cropping systems in the Great Lakes region," in Burundi, the DRC and Rwanda in 2008. The national agricultural research institutes in the three countries implemented the project. The project aimed at identifying and intensifying the best cropping systems to promote climbing beans.

Scientists first met with select smallholder farmers and other stakeholders to discuss the challenges of cultivating climbing beans, and modalities of how the scientists would work with selected groups of farmers. As part of the project, scientists developed varieties of high-yielding climbing beans seed and tested them together with farmers in the three countries.

Working with farmers, they identified two systems that intensify the production of climbing beans that were preferred by farmers.

These are intercropping the beans with maize, with the maize stalks serving as stakes; and mono-cropping beans using string stakes made of sisal and banana fibre with fewer woody stakes.

The scientists embarked on training extension workers and farmers on the correct planting methods, timely planting, correct intercropping, staking, soil conservation, managing pests and diseases, how to produce quality seed, and how to preserve beans for various markets. Various dissemination methods were used including on-farm demonstration plots, farmer field schools and farmer exchange visits.

Facts speak for themselves

Farmers are now recording increased bean yields and household income. Farmers who used string on average harvested between 780 and 3500 kg/ha, and got economic returns of US$ 1,300. Farmers who

Theresia and her peers dance to celebrate a good bean harvest

intercropped climbing beans with maize got bean yield range of 367 to 2,100 kg/ha, and the average economic return was US$ 2,030. Farmers who used only woody stakes on average got increased yields, ranging from 1,013 to 3,467 kg/ha and economic returns of US$ 950.

Says Ms Josephine Ntaconayigize of Gisozi Commune village, Burundi, "The bean varieties that we used to plant before gave very low yield and each year the yield continued to decrease. The improved varieties have provided us enough food for our families. We are also getting money from selling the surplus beans."

Mr Sindahebura Venerand, a farmer with the Kayokwe Association, Burundi, had an interesting observation about staking with string, "The advantage of this new technique is that birds, which have been a menace to our beans, cannot now easily see the flowers, which are covered by the leaves as the bean plants get entwined on the crossed stakes. Before, we were using short, woody stakes and the beans didn't have sufficient space to climb and pod."

Children in DR Congo eat porridge from QPM

Quality protein maize spreads like wildfire across the DR Congo

Quality protein maize, promoted by ASARECA, has found favour with millions of people in the Democratic Republic of Congo who call it 'maize-meat', 'maize-milk' or 'maize for life' due to its nutritious benefits. President Joseph Kabila allocated 500 hectares of land to multiply seed for distribution across the country.

Ms Numbuye Kanzeu, a resident of Gandajika, in the Democratic Republic of Congo could not hide her joy as she narrated her experience with Quality Protein Maize (QPM). "At the time I gave birth to my twins, I didn't have enough breast milk. A friend advised me to buy QPM flour from the nutritional center. After a brief period of taking the porridge the breast milk increased and my twins became healthy." Ms Kenzeu is not alone in praising QPM. "I got pregnant while the baby that I was breastfeeding was only six months old", says Ms Solange, another beneficiary "The baby could not get enough milk during my pregnancy and he became unhealthy. I was advised by a neighbour to feed my baby on QPM. I tried this out and the child recovered fully. We named him QPM baby." These are a few of the millions of parents in central and Southern DR Congo who have experienced first-hand the nutritious value of QPM

Since 2008, ASARECA has worked in the Democratic Republic of Congo (DRC), Rwanda, Ethiopia, Kenya, Tanzania and Uganda to promote cultivation and use of QPM.

The ASARECA project was called, "Transfer and dissemination of proven and emerging agricultural technologies in quality protein maize in ECA". It aimed at improving livelihoods, nutrition and generally incomes. The nutritional quality of QPM is close to the protein contained in cow milk. Since good sources

Ms Numbuye Kanzeu, a resident of Gandajika in DR Congo with her healthy children who benefited from QPM

of protein such as milk, meat, fish, eggs, and beans are expensive, promoting this maize was critical for ASARECA.

In DRC, child malnutrition is a serious problem, worsened by massive illiteracy and high levels of poverty. The project was implemented in three districts in Kasai province by *Institut National Pour l'Etude et la Recherche Agronomiques* (INERA), the agricultural research institute in DR Congo. INERA worked through its research center in Gandajika, one of the target districts. INERA partnered with a nutritional center in Gandajika where lactating mothers and malnourished children could access QPM flour. The results were impressive. Malnourished babies began to recover within days of feeding on the maize. The news about the 'maize-milk' spread across Kasai province and beyond, and the demand for the maize was overwhelming.

Over 40,000 people in DRC got involved in planting QPM to sell both as grain and as seed.

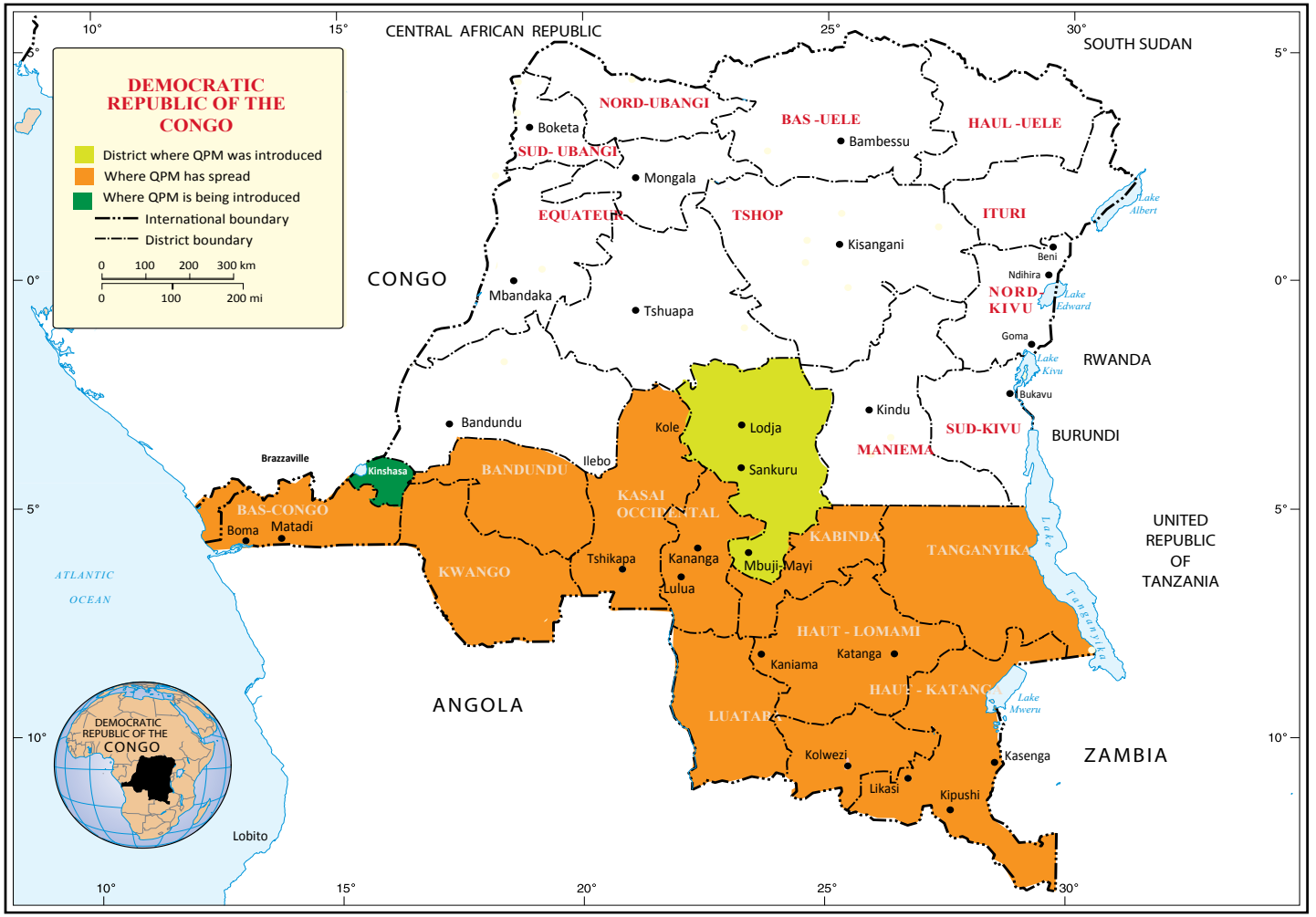
The ASARECA project provided farmers with QPM seed and training in related crop management practices to ensure they produce quality grain and seeds. Working with stakeholders in the QPM value chain, the project addressed related aspects of seed and grain production, processing and marketing. In certain parts of DR Congo, farmers would only buy maize if it was QPM. Hence certifying QPM has become important in the country. Because of its popularity, QPM production spread from Kasai province (in Central DR Congo) to southern part of the country.

Due to its popularity, President Joseph Kabila got drawn into QPM in May 2012, after learning about it on television coverage of a QPM event that was taking place at INERA in Kinshasa. The following day, he dispatched his agricultural advisor to attend the event. After the president received the feedback, the central government also joined in promoting QPM varieties to other parts of the country.

Mr Sam Mutumba poses in his maize store in Gandajika in DR Congo

Ntumba's Story

"I started producing QPM grain and seed three years ago after receiving seed from INERA, through the share cropping system," said Mr Sam Ntumba, a farmer in Gandajika. "I earn about US$ 5000 per year selling QPM seed to the government, to a Belgian-funded project and supplying seed to other farmers. My income level has tremendously improved - QPM has dramatically enhanced the health and wealth of my family."



The government of DR Congo allocated 500 hectares of land to INERA for scientists to produce QPM seeds for distribution across the country, and for grain production and processing. The following year, the State House agricultural department ordered for 1,000 kg of QPM seed for their farm. In addition, the Ministry of Environment and Nature Preservation bought 250 kg of seed to expand QPM production. The government has now availed small competitive grants to INERA to fund research for development for three years and a QPM project is among those that will be funded.

Rasha Adam extracts immature embryo from maize at Kenyatta University laboratories

Research breakthrough promises drought tolerant maize

"My country needs drought tolerant maize. I am set to support Sudanese authorities to carry out field experiments to get drought tolerant maize to the farmers," said Rasha Adam recently. Rasha, 34, returned to Sudan a year ago after completing her Phd studies based on the project, "Genetic Engineering of Maize for Drought Tolerance in Eastern and Central Africa", at Kenyatta University, Nairobi.

She is one of the five PhD students who ASARECA supported in 2011 to develop drought tolerant maize for the sub-region. Together, the young scientists successfully transformed nine farmer-preferred maize lines with drought-conferring genes. Rasha, who is from the Agricultural Research Corporation, Sudan, produced the ASARECA gene, PNOV-ASARAnxzm3.

24-72

The number of hours it takes for the GMO maize to recover fully after receiving water

The transformed lines include—two Ethiopian lines, three Kenyan lines, two Sudanese and two Tanzanian lines. They show more tolerance to water deficit. Maize plants from the transformed seeds may dry up in the absence of water, but when rehydrated, they are capable of fully recovering within 24–72 hours. The lines are under further scientific testing and multiplication in a screen house at Kenyatta University as plans get underway to transfer them to the various ASARECA countries for confined field trials.

First step to tropical GMO

The search for maize varieties that can withstand drought started in 2008 when ASARECA offered opportunities to students from Ethiopia, Kenya, Sudan and Tanzania to constitute a core research team to mitigate the drought challenge. The students were mainly from the national agricultural research institutes of the four countries. Kenyatta University was chosen in the spirit of complementarity, given its superior biotechnology laboratories and supervision team. Led by Prof. Jesse Machuka (RIP) and qualified biotechnology staff—Dr Richard Odour and Dr Steven Runo, the students started the journey to insert drought-tolerance genes into farmer-preferred maize varieties.

Desert gene into tropical maize

The first breakthrough came in 2010. The team successfully inserted drought tolerance-conferring genes from the desert plant *Xerophyta viscosa* and a model plant species, *Arabidopsis thaliana,* into local maize genomes. Concerted efforts continued to transform the varieties with other genes such as amiRNA1, amiRNA3,

NHX1, PMI, XvPrx2 and CBF1, known to confer tolerance to drought, leading to the breakthrough in 2012.

Tropical GMO seeds produced

Today, the results are there for all to see; a collection of freshly harvested, transformed genetically modified (GM) maize cobs are being bulked at Kenyatta University and leafy GM plants are either under further testing or multiplication at the screen house.

The first phase of the project ended in 2011 with the production of the first phase of seeds of the nine farmer-preferred tropical lines. A second phase of five years is required to advance these materials for commercial release.

Once they are released and adopted by farmers, it is hoped that maize production in the region will increase by 70%, and hence address the triple challenge of improving food security, reducing hunger and promoting economic development.

Why engineer maize?

Conventional breeding aimed at generating varieties that are resistant to drought has not yielded much success so far, and the region still lacks varieties that perform well under insufficient and erratic distribution of rain. Yet in this predicament, maize remains the most important staple food crop in

Phd students who transgressed drought tolerance into maize.

Eastern and Central Africa (ECA) with 80% of rural and urban populations depending on it as the principal source of calories.

Declining production

According to FAO, from 2006 to 2009, maize production in ECA decreased from 15.7 million tonnes to 14.7 million tonnes. The current maize yield stands at 1.3 t/ha compared with the potential of up to 7 t/ha projected by CIMMYT (the International Maize and Wheat

Improvement Centre). Seventy percent of maize yield is lost due to drought, which affects many African countries.

The ECA region is prone to drought, making farming extremely risky, especially for resource-poor small-scale farmers. The ability of smallholder farmers to cope with drought is hampered by the lack of crop varieties that thrive under insufficient and erratic rainfall conditions. This has exposed many farmers to the devastating effects of drought such as crop failure, leading to hunger and poverty.

70%
The percentage of maize yield lost due to drought, which affects many African countries

It is against this background that ASARECA, Kenyatta University and the national agricultural research institutes in the region came together to develop drought-tolerant maize and make it available to farmers.

A farmer from Madagascar shows off healthy onions harvested in the off-season following application of efficient water management innovations.

Managing water to tame harsh environments

Over 1,500 households in Eritrea, Ethiopia, Kenya, Madagascar and Rwanda adopted technologies to use water efficiently. In these countries, up to 5,000 hectares of severely degraded land was rehabilitated through the use of efficient water conservation and management practices in selected watersheds. This has increased the amount of water available to support agriculture, and over 1,000 households previously dependent on food relief are now food secure.

Until 2012, Anthony Mwangangi Kieti, a farmer in Machakos in Kenya, was sure that his land was useless. The land was rocky and severely eroded by massive runoff experienced in the area every season. To survive, Mwangangi, like most farmers in Machakos, reared goats because they were more resilient in such harsh conditions.

Mwangangi's outlook, however, changed in 2011 when he visited demonstration farms set up at Kenya Agricultural Research Institute (KARI) to train farmers on how to harvest and manage rainwater to increase agricultural productivity. "I realised that an area that was once degraded had been turned around and different varieties of crops were being grown. From then on, I knew that I could do the same," he says.

1,500
Number of households in Eritrea, Ethiopia, Kenya, Madagascar and Rwanda that have adopted technologies to use water efficiently

Trapping water from the slopes

In 2011, Mwangangi expressed interest to ASARECA research teams from KARI that he wanted to implement innovations that he saw at the demonstration farms ASARECA research teams did not disappoint him. Besides financial support, the teams offered Mwangangi advisory services needed to turn around the wasted hill into an agricultural hub. Motivated by the support, Mwangangi dug deep into his own pocket, injecting Kenya shillings 70,000 (US$875) from personal savings to cut benches from the top to the foot of his sharp gradient land.

"ASARECA teams contributed to and monitored every step of transforming this hill for the better until runoff was stopped. Together we changed the soil structure by scooping out and putting aside stones and mixing the good soil with compost manure to plant trees, fodders and Napier grass. Slowly, I was also able to introduce food crops like maize, cow pea, pigeon pea etc, and became self sustaining within this space," said Mwangangi.

Through Mwangangi, ASARECA and partners created a role model for Mwania watershed, covering about 900 hectares. Today, the community has planted over 3,000 *bracharia* and *nsena* seedlings and over 500 seedlings of indigenous trees. By the close of 2012, they had planted 20,000 trees.

Gladys Mwasia, Mwangangi's neighbour was also one of the first line beneficiaries of

the climate smart winds of change. Using the new innovations including benches, tied ridging, compost manure, certified seed and following weather advisories, she is one not to look back to days of want.

These are testimonies of farmers that ASARECA and partners are working with to control the effects of climate change using water innovations. The initiatives, under the project, "Integrated management of water for productivity and livelihood security under variable and changing climatic conditions in ECA", started in 2011. To date, it has scaled out innovations and practices to promote the efficient use of water in selected watersheds in Eritrea, Ethiopia, Kenya, Madagascar and Rwanda. These are areas with extreme degradation, high poverty levels and, in most cases, dense populations.

The project was implemented by the national agricultural research institutions in each country. Demonstration farms were set up to sensitize farmers on how to conserve runoff from rainfall using check dams, terraces, tight ridges and other water-conserving techniques.

Farmers were also exposed to better farming practices such as crop rotation, intercropping, use of chemical fertilizers and farmyard manure, seed priming, early planting, use of certified seed and, and use of seasonal forecasts to minimize losses in bad seasons and maximise the benefits in good seasons.

Besides direct support to farmers, ASARECA established and equipped stations in the project sites to measure the extent to which soil erosion could be reduced following some of the landscape innovations. The outcome will be available in one or two years from now. ASARECA also provided weather prediction and measurement equipment to aid the weather advisors and farmers to manoeuvre climatic variations.

Gladys Mwasia at her maize farm in Machakos, Kenya

Gladys's Story

"From barely anything in the previous years, in 2011, I harvested 2,500 kg of maize in the first season and 3,000 kg in the second. Now I get twice that amount," she notes. "Before maize growing was a no-go area because it needs lots of water."

Barren no more

In all the participating countries, farmers who embraced these technologies and innovations rehabilitated previously barren lands and increased crop yields. By the end of the project in 2013, maize yields in the two watersheds in Kenya had increased from less than 500 kg/ha at project inception to 3 t/ha and over 70% of the households were now food secure.

In Madagascar, adoption of improved rice varieties increased rice yields from 2 to 4 t/ha while onion yields increased from 10 to 25 t/ha due to prudent management of water and other inputs. As a result, communities in the two watersheds of *Ankazomiriotra* and *Avaratrambolo* are now 60% food-secure Farmers in Adulala in Ethiopia managed to harvest and sell

pasture/grass worth US$ 10,749 from rehabilitation of formerly degraded hills.

By constructing soil and water conservation structures such as terraces and tied ridges, farmers in *Molqi* and *Amadir* watersheds in Eritrea were able to harvest 1.5-2t/ha of sorghum compared to 600kg/ha at project inception. This was despite both *Molqi* and *Amadir* being naturally marginal for agricultural production. They are also able to enjoy clean water from *Molqi* and *Amadir* dams after adopting sound soil and water conservation measures. Farmers in Eritrea also dug 6,000 tumbukiza pits to harvest water and establish woodlots of drought-resistant eucalyptus trees. Eucalyptus is providing raw material for the cottage wood carvings industry.

70%
Number of households that have become food secure following the project

Using weather advisories

Besides improving productivity of agricultural water, the project promoted the use of seasonal climate forecasts to minimize losses in bad seasons and maximize on the opportunities presented by good seasons. The seasonal forecast is translated into actionable agricultural decisions (advisories) by experts drawn from the projects innovation platform and disseminated to farmers at the start of every season to help them make informed decisions.

The advisories are provided in a language farmers understand so they can make informed decisions on when to plant, what to plant, how much to plant and how to plant to avoid yield losses caused by late planting. According to Kwena Kizito, the principle investigator of the project, crops planted on time have higher chances of success than those planted late.

Meshack Mwania from Kalii watershed, Makindu, Kenya agrees:

Meshack's story

"We receive very limited rainfall. A difference of one week of planting is enough to make or break the crop, so we take weather advisories seriously. The advice has enabled us to select drought-resistant crops such as cowpea, greengram and sorghum. Every household here now has enough food to last the year. This was not the case three years ago. That is partly how we are responding to climate change."

Meshack Mwania from Kalii watershed, Makindu, Kenya shows off his cow-pea ready for harvest

A farmer from Mwanza, Tanzania with her most rewarding milk cow

Crop-livestock innovations
boost incomes of rural farmers

Through training and promoting a mix of technologies for cattle feed, forage choppers, water harvesting technologies and vegetable growing, the ASARECA crop-livestock integration project has helped hundreds of women in Eastern and Central Uganda to flourish from dairy and vegetable production, feed their children on nutritious foods and become leaders in their communities.

For Ms Muwanga and twenty other members of the Abandemu women's group in Buyikuzi village in Masaka district in Central Uganda, crop-livestock innovations have made a difference in their lives.

Muwanga's story

"I intercropped Lablab with maize and harvested 16 bags of maize grain from one acre compared to nine bags I used to harvest from maize mono-crop. I dried the lablab and mixed it with maize stover and conserved it as animal feeds. As a result, milk production from my two cows increased from 10 to 16 litres per day. I was also able to sell excess residues to urban dairy farmers. I am now able to earn about Ushs 120,000 per month from milk sales and about Ushs 300,000 per year from the sale of residues from maize-lablab intercrop and maize bran, and that has helped me send my children to school."

Abandemu group members say they have benefited a lot since ASARECA started working with them through the crop-livestock integration project. More especially, they appreciate the training that has helped them to improve on how to feed their animals and to start other income generating enterprises such as poultry and piggery.

"We appreciate the improved forages (especially *Bracharia mulato*) that make our animals look healthy," says the group chairperson, Ms Nakakande. "Lablab helps to control weeds when intercropped with food crops like maize. Because of

Ms Muwanga shows off a nutrient block

the way it spreads, it acts as a cover crop and reduces the cost of weeding by 50%. Lablab also improves the quality of milk by increasing the butterfat content of the milk. When young lablab leaves are harvested and dried, they make very good source especially when mixed with groundnuts".

Project teams inspect a plot of lab lab

Ms Philista Galiwango, another member of the group says she received seeds for Buga, and Nakati (indigenous vegetables) and Lablab for fodder. She says the vegetable yields have been increased by 20 times because of irrigation and application of composted manure from the zero grazing dairy unit. I can now sell vegetables throughout the year. She is able to get Ug Shs 300,000 from sales of vegetables during the dry season in addition to that consumed at home. Part of the income generated from the vegetables is used to pay school fees (Ushs 150,000) for her three children who are still in primary school.

"The fodders have helped me feed my animals and they look healthier. Thirty four farmers who are not members of our group admired our achievements and are adopting some of the practices such as Lablab- maize mix and irrigation," says Ms Galiwango.

The success in this group has attracted many other farmers from within and outside the district. We have received farmers from Ethiopia, Burundi, Tanzania, Rwanda and government officials such as the Minister of State for Agriculture, Members of Parliament and church leaders who came to learn from our group.

These testimonies are a product of the ASARECA project, "Crop–livestock integration for sustainable management of natural resources and building livestock resilience in Eastern and Central Africa." Started in 2010, the project covered Uganda, Tanzania, Kenya and Burundi in response to studies that indicated that the major problems discouraging farmers from practising mixed farming were inadequate feed supply, frequent dry spells, and shortage of labour, poor soils and lack of basic information on best practices.

The project set out to introduce a mix of integrated innovations such as fodder trees *gliricidia (Gliricidia sepium), calliandra (Calliandra calothyrsus)* and *sesbania (Sesbania sesban)* on-farm to supplement feed for dairy cattle while improving soil fertility.

Other innovations were intercropping Napier grass with the tropical forage legume Centrosema pubescens and maize

with the forage legume Lablab; small-scale hay and silage-making techniques; a modified fixed-knife forage chopper for cutting fodder for dairy cattle; and rainwater harvesting for drip irrigation.

The project also addressed issues along the value chain. In Nyamagana district, Tanzania, a milk producers group comprising 25 men and 15 women was formed to address challenges of milk marketing. The project helped them to establish a milk collection centre and linked them to hotels and restaurants, ensuring a steady market.

This attracted complementary support from the Mwanza Municipal Council who provided the group an extra milk cooler, as well as the Nyamagana district administration, who gave them 20 extra milk collection cans.

The number of farmers involved in dairy production is steadily increasing. In Eastern Uganda, four marketing associations, each with 30 farmers, were established to manage vegetable marketing. These associations have initiated three vegetable collection centres to ease joint marketing.

Ddaki's story

Mr Peter Ddaki and his wife Nnalongo of Kitenga village, Masaka, Uganda say,

"Because of support from ASARECA, we produce about 41 litres of milk daily from our three dairy cows. We consume five litres at home and sell 35 litres. This gives us about Uganda shillings 36,000 (US$ $ 15) daily or shillings 1 million ($ 430) monthly. Every year, we produce enough food for sale and for family consumption. We are able to satisfy our nutritional needs, pay school fees and meet other financial obligations. We have an underground rainwater tank provided by ASARECA, which we use to irrigate the various food and fodder crops on our four-acre farm; and for the livestock to drink. We use an improved forage cutter provided by the project. Previously, we used crude tools like the machete and this came with the risk of chopping off our fingers. We use cow dung and urine collected from the zero-grazing unit and other organic materials to make compost manure for fertilizing the gardens. The banana leaves and trunks also provide mulching material for the soil and plants."

The Ddaki's at work

Farmers in Rwanda mulching their garden of eggplant

Burundi soldiers of peace now soldiers of nutrition

Through provision of clean seeds for African indigenous vegetables, training, linkages to seed producers and other strategic support, ASARECA is helping improve nutrition as well as create income for women and youth in Rwanda, Kenya, Uganda and Tanzania.

They are known as 'ABANIKI', which means women of peace and development. Their group association leader, known as General Goergette, has become an advocate of the African Indigenous Vegetables (AIVs), after learning about their nutritious benefits. She has been featured on Burundi National Television and radio advocating for the vegetables.

"With the prevalence of poverty and diseases like HIV/AIDs, African indigenous vegetables are very helpful in improving the health of our local community, especially children. Their consumption has increased because we are educating people about their nutritional benefits. Besides, AIVs are acting as a source of income for the ABANIKI group," says the outspoken Goergette.

During the civil war in Burundi, families disintergrated and poverty reached the highest level. As desperate single mothers, faced with severe economic crises, the women came together and formed a support group, ABANIKI. One of their major objectives was to promote peace in the community; and they did ensure that communities from different ethnic groups coexisted peacefully. As a result, the group earned the name: 'Jeshi la Amani' (Soldiers of peace).

With their leader called "General". Burundi is now stable and recovering from the effects of the 12-year

A woman in Burundi selects tender amaranthus leaves for sale and for home use

civil war and the peace initiative group has evolved into a community development support group. When they heard about the ASARECA supported AIV project, they were eager to know what it was all about. As a result, General Goergette was sent on a fact finding mission to a workshop organized by ISABU in early 2013. "Initially I was sarcastic about the indigenous vegetables because we did not think that anything good could come from them," says Goergette.

ABANIKI consists of 82 women who are involved in the production of African eggplant, a common AIV. The group produces seed, leaf and fruit of the eggplant for domestic consumption and for the market.

Their journey towards becoming producers of AIVs began in 2013, when they earned 320,000 Burundi Francs (about $US 200) from selling African eggplant seed from their first jointly owned seed plot. This initial earning was ploughed back into AIV farming under a bigger portion of land planted with African eggplant for seed production. The group usually shares profits only after it accumulates to at least 1 million Burundian Francs (about US$ 700). The group members have also diversified into producing eggplant from individually owned plots.

Members of ABANIKI had been producing eggplant with difficulty from their own traditional seeds before improved seeds were introduced through the ASARECA AIVs project. Asked how the improved seeds are different from the traditional ones, one of the group members said: "All AIV seeds germinate and their leaves are healthier."

One of the Abaniki members watering vegetables

Borrowing from the strategies employed by the community to promote peace, Goergette is now promoting the production and consumption of the AIVs. "Malnutrition is one of the challenges facing people in many parts of Burundi. The indigenous vegetables, which grow faster with little input, should be grown by every family," she advises.

AIVs have a short production cycle, and usually record high yields with few purchased inputs. They therefore, support rural, peri-urban and urban populations both in terms of food security and income-generation, with low capital investments.

AIVs are particularly attractive to women farmers and the youth. Indigenous vegetables have very high levels of iron, calcium, and other valuable minerals. Their demand in the markets is huge and increasing as more people become conscious of healthy eating and the nutritious benefits of AIVs.

$3,500
Average income for African indigenous vegetables farmers in Kenya

The future of farmers engaged in AIV production is bright. In Kenya for example, several farmers who produce AIV seeds are earning about US$3,500 per hectare per annum.

African indigenous vegetables such as eggplants and *amaranthus* are widely consumed in many parts of the ECA. However, before support from the ASARECA AIVs project, production of the vegetables was generally low due to the unavailability of good quality seed, lack of well-organized seed supply systems for AIVs and lack of knowledge among farmers on the management of vegetable seeds.

Through a study conducted in 2008, ASARECA had established that smallholder farmers sowed saved seed which carried the risks of having mixed varieties, low germination rates and diseases that resulted in low yields. The study also noted that AIVs were not attractive to private sector seed producers and so farmers had problems of accessing quality seed. Following the study, ASARECA launched the project named, "Scaling up farmer-led seed enterprises for sustained productivity and livelihoods in ECA." The project was first implemented in Kenya and Tanzania, and later scaled out to Burundi, Rwanda and Uganda.

The project promoted seed production and marketing models which target the AIV value chains both for seeds and vegetables, ensuring production and supply of quality (certified) seed and market linkages for both the seed and vegetables. Farmers were provided with improved AIV seeds and trained in agricultural practices, identification of appropriate varieties and business acumen, thus leading to production of high quality seeds.

Seed certification mechanisms were built into the models. Farmers were also linked to seed companies for contract seed production and to ensure marketing of the seeds produced by farmers.

Dr Habonimana Fidele, the Director of AVET, a commercial seed company in Burundi, says with the improved, high quality seeds, farmer groups and AIV Trader' Associations were strengthened through the ASARECA project.

AVET is one of the beneficiaries of the project, having been linked to farmer-seed enterprises. "AIVs farmers benefit from contract farming with AVET as there is ready market for their seeds," explains Célestin Niyongere, who is the focal person for the ASARECA AIV project in Burundi.

Good sorghum harvest in Singida, Tanzania. With Striga, this kind of harvest cannot be realised

Striga-resistant sorghum varieties criss-cross sub-region

Four Striga-resistant sorghum varieties that were generated in Sudan using ASARECA support are now undergoing adaptation trials and field testing in Uganda, Kenya, Tanzania and Rwanda. These four varieties have already been released to farmers by the government of Sudan.

In 2012, the government of Sudan released four lines of Striga-resistant sorghum varieties that were generated by an ASARECA-supported project. The new varieties have mechanical barriers that make it impossible for striga to penetrate and 'feed' on the sorghum plant. The released lines are capable of yielding up to 3.6 tonnes per hectare. The release of the Striga resistant varieties was a major breakthrough in the application of biotechnology to address a severe problem that was being faced by Sorghum farmers in ECA.

Sorghum is ranked second after maize as the most important cereal staple crop in the ASARECA region. However, its

A striga infested crop in Wad Medani in Sudan

A sample of striga resistant varieties that have been shared among member countries through ASARECA

Well performing sorghum in Madagascar

production is constrained by Striga, a parasitic weed that can cause yield losses of up to 100%.

Striga is considered second only to drought as the factor that reduces the yield of staple food crops in Africa. Striga severely affects the growth of staple crops that are critical for poor smallholders. It is referred to as 'witch weed' because it shows up openly only after gaining advantage over the crop.

This means the damage is done while the weed is underground. A single striga plant can produce over 50,000 tiny dust-like seeds, creating huge seed banks that are easily spread by wind, animals farming tools and running water etc. To make matters worse, striga seeds can survive in the soil for up to 20 years.

100%
The yield loss caused by striga once it infests a farm

In Africa, 21 million hectares are estimated to be infested with striga. In ECA, over 3000 ha of sorghum are infested by striga. This represents a 32% infestation rate causing 22% yield loss. This is equivalent to about 2.3 million metric tonnes of sorghum annually. In monetary terms, this translates to a loss of about US$623 million annually.

Rescuing sorghum with biotechnology

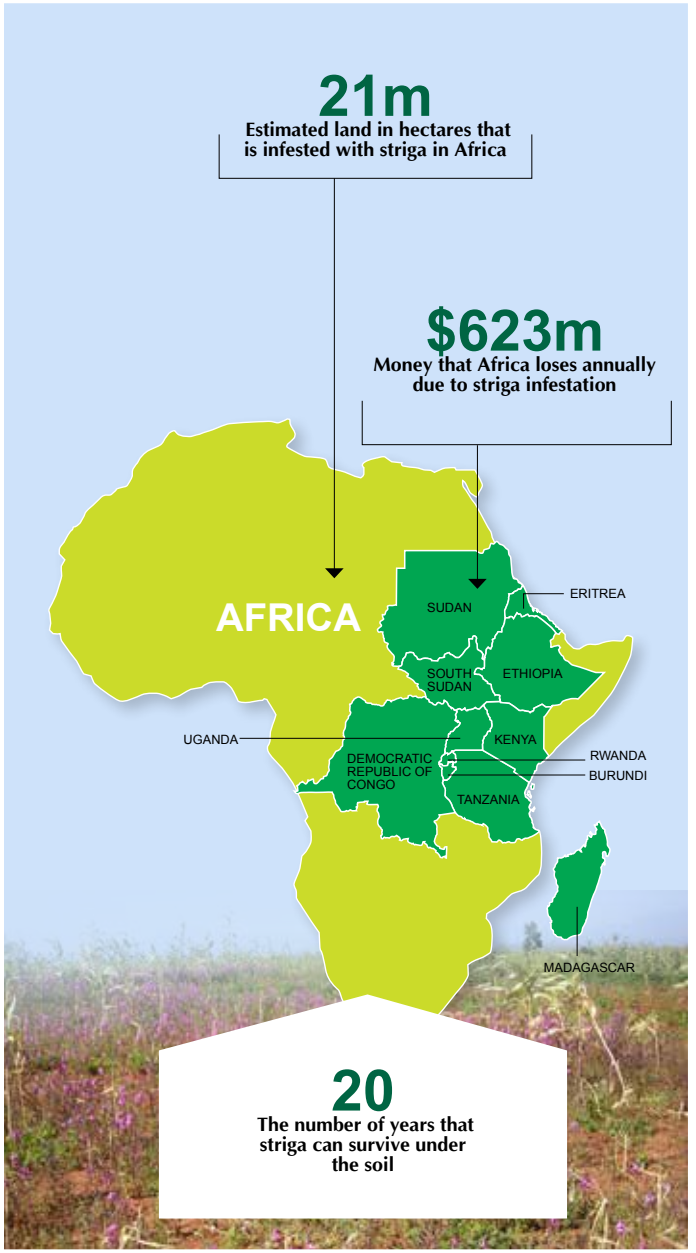
Against this background, ASARECA in 2008 mobilized and supported a team of scientists from the Agricultural Research Corporation of Sudan (ARC), the University of Nairobi (Kenya), the National Agricultural Research Institute of Eritrea, the Rwanda Agricultural Board, and the International Centre for Agricultural Research in Arid and Semi Arid Tropics (ICRISAT).

Their task was to develop Striga-resistant sorghum lines using a biotechnology tool known as marker-assisted selection, reputed for its precision and effectiveness in breeding for Striga resistance. The breakthrough was made by the Sudanese scientists who developed the four striga-resistant sorghum varieties, code named ASARECAT1, ASARECAW2, ASARECAAG3, and ASARECAAG4. These four varieties were released in Sudan by the official variety release organs.

Following the release in Sudan, the varieties underwent trials for adaptation in Uganda. The lines were tested at National Semi Arid Research Institute, Uganda, for striga resistance, farmer acceptance and colour.

Following the successful trials, the sorghum was bulked to increase seed, and the sorghum seed was shared with Kenya, Tanzania and Rwanda to carry out their own trials to adapt the varieties to their ecologies.

With the four varieties released and being adapted in ASARECA member countries, and 22 others being evaluated, progress towards restoring the productivity of 17 million hectares of land threatened by Striga is in sight. This will make an important contribution towards taking 300 million people in Eastern and Central Africa (ECA) out of hunger.



A woman displays a good cassava harvest

Harmonized standards open up borders for cassava, potato

Cassava and sweet potato products can now be traded across five countries; Burundi, Kenya, Rwanda, Tanzania and Uganda. This follows the approval of 25 standards facilitated through ASARECA. Standards are detailed descriptions of the required quality for products (or services).

Asiyo's story

"Over the last three months (September 2013 to date) we have produced more than three tonnes of high quality cassava flour. Of these, one (1) tonne was supplied to Britania, a top biscuit-making factory in the capital city, Kampala. More than two tonnes of the flour was bought on site by food retailers, "says Norah Asiyo Ebukalim. She is the team leader of the Popular Kumi Women Initiative (PKWI), a cooperative of 3,000 farmers who grow and process cassava in Eastern Uganda. "We want our flour to be certified so that it can move across East Africa. "Our products have already passed all Uganda National Bureau of Standards (UNBS) tests. We are only left with certifying the labels... then we will have the 'Q' mark, which will enable us to sell the product anywhere in East Africa."

The Popular Kumi Women Initiative was formed by small scale farmers a few years ago, to add value to cassava as a step to access bigger and lucrative markets and earn better income.

Although the group is yet to fully exploit the local (national) market, their motivation to add value to cassava is to tap better opportunities offered by the region. In this direction, PKWI has subjected their products to tests by the National standards regulator, the Uganda National Bureau of Standards (UNBS).

Another cooperative in Soroti in Eastern Uganda, FARMCo, produced 15 metric tonnes of high quality cassava flour for the high-end market using East African standards. Makerere University's Department of Food Science and Technology is making cassava chips based on these standards, and the products are already on the market in Uganda.

Tom Cris Enterprises Limited, one of the pioneer and largest processors of potato crisps in Kampala, is improving the packaging of their products as required in the standards and is already selling within the East African Community.

In Kenya, KIWAFA and Uwezo Mashambani farmer groups are consulting the Kenya Bureau of Standards on the procedures for acquiring the quality mark for potato crisps including bar codes to access the supermarkets chains.

In Rwanda, farmers recognized the importance of good agricultural practices and committed to start harvesting cassava and potato at the right stage of maturity and using agricultural chemicals and pesticides according to recommended standards. Three pilot potato crisps processors in Rwanda have put in place a quality control system for oil, fresh potato, salt etc., hygiene and parking materials to meet the overall standards.

These are some of the first signals that opportunities for small scale cassava and potato farmers and traders in East Africa are bound to expand following the approval of 25 rationalized and harmonized standards for cassava and sweet potato and related products by the East African Community.

The standards are: Fresh sweet cassava specification, dried cassava chips specification, cassava flour specification, food grade cassava starch specification, cassava wheat composite specification, cassava and cassava products determination of total cyanogens, potato crisps specification, frozen potato chips specification, fried potato chips specification, fresh potato specification, seed potato specification, bread specification, fresh sweet potato specification, dried sweet potato chips specification, sweet potato flour specification, sweet potato crisps specification, production and handling fresh ware potato code of practice, production and handling fresh cassava code of practice, reduction of acrylamide in potato products code of practice, fresh bitter cassava specification, high quality cassava flour specification, fresh cassava leaves specification, biscuits specification and composite flour specification.

A young girl in Burundi takes harvested potato home

Cassava products: Flour, mandazi, baggia, crisps, biscuits

The process to harmonize and standardize cassava and potato quality and trade requirements was started by ASARECA in 2006. The initiative was meant to enhance the value of the two root-crops, open a window for their inclusion in the production of industrial products, and promote trade in their products across the East African Community (EAC). ASARECA worked with the Uganda National Bureau of Standards (UNBS), which compiled a list of proposed standards for the two commodities. Using the EAC template, UNBS formally sent the list to the other four EAC countries as zero drafts for consideration and adoption as regional standards.

Using its vantage position as a sub-regional agricultural research organization, ASARECA supported the technical departments of the standards bureaus of Burundi, Kenya, Rwanda, Tanzania and Uganda to convene national consultations to discuss the zero drafts in 2009. ASARECA convened and facilitated discussions among the bureaus and other stakeholders including the International Institute for Tropical Agriculture (IITA), the International Institute for Potato Research (CIP), cassava and potato researchers, industry players, farmers and parliamentarians in the 5 countries. Following long consultations and concerted efforts among the member states, a proposal was tabled before the Standards technical sub-committee of the East African Community.

Although the pace of implementation is painfully slow across East Africa, standards and value addition activities are getting incorporated into central and local government programmes to ensure sustainability. In Kenya, as a result of awareness about the project benefits, one of the groups from Ndaragwa has been earmarked and recommended to benefit from a county grant towards the purchase of the cassava/potato processing equipment.

In their raw state, cassava and potato are perishable, high-volume and low-value commodities. The use of cassava includes high-quality flour; improved versions of traditional processed products; use in livestock feed rations; high-quality cassava flour is of particular interest because it can substitute portions of wheat flour in bread, pies, pastries, cakes, biscuits and doughnuts. It also has industrial applications.

Value-addition technologies, though well developed for some products, were hardly used due to a lack of clear guidelines on standards and supportive policies.

The standards were published in the EAC Gazette, 16 July 2010 http://www.eac.int/customs/. Specifications of each of the standards are available at https://law.resource.org/pub/eac/ibr/

A farmer prepares to harvest pineapple

Empowering smallholder farmers to raise their fortunes

By providing targeted capacity development to farmer organizations, establishing the right partnerships and implementing innovative processes, ASARECA has assisted farmer groups in four countries in Eastern and Central Africa, to participate in competitive markets. Members of these smallholder farmer groups now get better returns for their produce.

The majority of farmers in East and Central Africa (ECA) are smallholders. They depend on small plots of land (5 acres or less) as sources of both food and income for their families. However, for too long, their crop quality and yields have remained very low. They are unable to access or compete favorably in markets for their produce, resulting in very low earnings from farming.

A key root cause of the lack of competitiveness among smallholder farmers in ECA is the low levels of self-organization among them. It is widely recognized that farmer organizations are vital for transforming smallholder agriculture into profitable enterprises. Through farmer organizations, smallholder farmers collectively benefit from access to services, achieve economies of scale in markets and acquire a stronger voice in demanding quality services from both the public and private sector.

In 2010, ASARECA profiled farmer organizations in six ECA countries. The results showed that most farmer organizations lacked the capacity to empower their members to participate competitively in the agricultural value chains they engaged in.

Rice is stored in a safe store owned jointly by the farmers

To address these challenges, ASARECA initiated a project titled, "Farmer empowerment for innovation in smallholder agriculture", also known as the FEISA

project. The project was set in four countries Burundi, Ethiopia, Kenya and Rwanda. The objective of the project was to enhance the capacities of national farmer organizations, in the target countries, to deliver services that enable farmer groups to ably engage in their selected value chains.

The project was carried out in partnership with the Eastern Africa Farmers' Federation; the national farmer organizations; the Royal Tropical Institute and Wageningen University both from the Netherlands. Through the project, the national farmer organizations were trained in areas and skills, which they had identified

Farmers start off the post harvest handling process at a rice field

as weaknesses, for service delivery to their grassroots member organizations.

The focus was on improving services that would enable farmer groups to prosper from existing market opportunities. As a result, the national farmer organizations were able to facilitate interactions between grassroots farmer groups, agri-business and service providers. In addition, the project set up innovation triangles around selected value-chains in each of the four countries (two in each country).

Through an innovation triangle, the national farmer organization, working with a specific grassroots group, would do a quick analysis of the selected value chain. Together, they would identify both the market opportunities and the barriers to overcome ('burning issues'). The grassroots group would then be given the specified services to enable them to thrive in the value chain. Several successes were registered from the project, two of which are highlighted below.

Storing rice for higher prices

For 68 rice farmers in Mutimbizi district, Burundi, 2011 marked the start of earning windfalls from paddy rice cultivation. The farmers, members of Girumwete Dukore cooperative, sold 417.5metric tons of rice, which they had stored in a warehouse at 900 Fbu (US$ 0.57) per kg.

If they had sold the rice right after harvest, they would have been paid 400 Fbu (US$ 0.25) per kg of rice. With this increase, the farmers were able to cover production costs, which were estimated at 420 Fbu per kg. Furthermore, while waiting for the rice to be sold, the farmers were able to get credit of 180 Fbu per kg of rice in storage.

The burning issue addressed

Producing rice in the correct way requires a lot of inputs from sowing to harvesting, which are not always readily available for smallholder farmers. In order to finance their activities, farmers took loans from rice traders. They were then obliged to sell their rice to the traders (their creditors) at harvest time, when the prices were low.

Because they sold the rice at low prices, farmers made little or no profit and the same cycle of debt started again the next growing season. At harvest time, rice prices could be as low as 400 Fbu per kg rising up to 1,000 Fbu per kg three months later. It was during a meeting organized under the FEISA project for rice value-chain stakeholders in Burundi (May 2010), that the stakeholders identified access to credit for farmers to be a burning issue. The meeting was organized by the national farmers' organization in Burundi called CAPAD.

Working with the Girumwete Dukore cooperative, CAPAD brought on board FENACOBU, a microfinance institution as a partner to address issues of financing smallholder rice production, selling of rice at the right time and market intelligence. FENACOBU introduced the warehouse receipt system, which was already in use in other areas in Burundi.

This system allows rice to be stored until market prices are high, and at the same time enables farmers to receive credit to finance their activities. CAPAD then organized a series of meetings with the rice farmers to sensitize them about the advantages of the warehouse receipt system and how to ensure the system functioned well. CAPAD

also held a series of capacity development workshops to set out the foundations of the warehouse receipt system. These included defining rice production costs to set a minimum sale price so that farmers make some profit; identifying market outlets for rice; and defining principles for establishing contracts between farmers and traders and between the cooperative and FENACOBU.

On harvesting the paddy rice, the farmers took their rice to the cooperative, had it weighed, bagged and registered. The cooperative stored the bags in the warehouse.

FENACOBU then gave credit to the farmers, through the cooperative, based on the estimated value of the rice stored in the warehouse. Months after harvest, when market prices for rice were high, the stored rice would be sold to buyers by the cooperative. The cooperative in turn paid the farmers, after subtracting the credit.

Accelerating production of high quality pineapples

Across the border in Rwanda, ASARECA facilitated similar interventions using the innovation triangles approach. Working with IMBARAGA, the apex farmer organization in Rwanda, ASARECA strengthened the capacity of a grassroots farmer group, the COAFGA, a fruit growers' cooperative in Gakenke District, to deliver member-demanded services.

As a result, members of the cooperative, increased production of pineapples from 30 metric tons per ha per season to between 45 to 50 metric tons per ha per season and are now fetching higher prices for larger pineapples. This is due to application of a new 'micro-propagation' technology for planting pineapple.

The fruits from micro propagated materials weigh between 2.5 and 3.5 kg per pineapple, compared to 1 to 2 kg when farmers used suckers from mother plants. Pineapple is an important crop in Rwanda due to the proliferation of post-harvest processing businesses. Each week, at least 50 metric tons of pineapples are transported from Gakenke District to the capital city, Kigali, and a nearby town called Rubavu.

50mt

The quantity of pineapples that the affected farmers are now harvesting and selling per week

Good quality materials

Lack of good quality planting materials was identified as a challenge during a workshop for representatives of stakeholders from the pineapple value chain. As a result, RAB trained 90 small-scale farmers of COAFGA in applying a pineapple micro-propagation technique to produce their own high quality planting materials. RAB also monitored progress of the COAFGA farmers.

COAFGA encouraged its members to set up plots for micro-propagation by providing organic manure, ploughing services, supply of crowns (upper sections of pineapple which were used for multiplication), and management of the nursery and the planting process.

Pineapple juice at value addition stage

Following the success of the micro–propagation technology, the Gakenke district authorities have requested the COAFGA cooperative to promote the technology to other farmers in all 19 sectors of Gakenke District.

In Rwanda, Burundi and the rest of the participating countries, the FEISA project clearly illustrated how well-functioning farmer organizations enabled smallholder farmers to effectively articulate their demands, engage in collective marketing and gain access to various goods and services. Different farmer organizations required different types of interventions which were identified through consultations that brought together the various value chain actors.

SCARDA scientists drive agricultural research in Rwanda and Burundi

Until 2008, Rwandan scientists Leonidas Dusengemungu, Gafishi Kanyamasoro, Uwizera Mathilde, Cyamweshi Rasangama, Wilson Dufitumukiza and Maximillan Manzi were junior researchers. Their colleagues from Burundi—Nepomusecene Ntukamazina, Michelin Inamahoro, Fulgence Niyongabo, Cyrille Mbokihankuye and Gloriose Habonayo—were in much the same boat.

However, this situation has since changed. These scientists are now in charge of strategic agricultural research areas in their countries, thanks to the ASARECA initiative, Strengthening Capacity for Agricultural Research and Development in Eastern and Central Africa (SCARDA). In their new positions, these scientists have three urgent tasks: confront food insecurity, malnutrition and boost farmers' incomes.

Their story dates back to 2008 when ASARECA sponsored 34 young, mid-level scientists from Eastern and Central Africa to undertake leadership and mentorship training, and master's degree training in various disciplines including Plant Breeding, Soil Science, Agronomy, Agricultural Information and Communication Management, Research Methods, Range Management, Agricultural Extension and Breeding.

Through the project, Strengthening Capacity for Agricultural Research and Development in Eastern and Central Africa (SCARDA-ECA), ASARECA teamed up with the Forum for Agricultural Research in Africa (FARA) and the Regional Universities Forum (RUFORUM) to place the students in acclaimed universities in the region.

The students were selected from the Agricultural Research Corporation (ARC) in Sudan, Institut des Sciences Agronomiques du Burundi (ISABU) and Institut des Sciences Agronomiques du Rwanda (ISAR), now the Rwanda Agricultural Board. These countries were chosen following an institutional assessment of the national agricultural research systems conducted through country scoping studies, spearheaded by ASARECA.

The scoping study indicated that lack of adequate human resource capacity was a major weakness in delivering research outputs to meet the needs of the poor. In addition, the study outlined priority research areas for the three institutions, which provided the basis for selecting the relevant courses for the MSc students.

Experienced supervisors from both Universities and NARIs were identified and attached to the students for continuous technical and professional support. The students from ISAR (now RAB) and ISABU also received pre-entry English training which enabled them to acclimatize to the English teaching environment in the various universities in East Africa.

The students also received training on proposal writing, scientific writing and publication. They were supported to publish their research work at the end of the studies and establish a network of other researchers in the region and beyond with whom they would collaborate with in any future calls for research funding.

ASARECA supported the institutionalization of mentorship in ISAR, ISABU and ARC. SCARDA trained a pool of researchers on the approaches of mentoring, leadership and management, which subsequently led to adoption of the mentoring approach in the three institutions. Similarly, a number of workshops aimed at integrating the students back into their home institutions were conducted.

The scientists successfully completed their courses in 2010 and returned to their respective countries early 2011.Two years later, ASARECA tracked them to see what contribution they are making to their countries. The following are highlights of their work:

Leonidas Dusengemungu, Rwanda

Leonidas was recently appointed national head for the Innovation Platforms in Rwanda. Leonidas did an MSc in Agricultural Extension and Education at Makerere University. While at Makerere, he was introduced to the innovation platforms of FARA, which are considered a model for participatory research on the continent. When he completed his studies in 2010, he was immediately appointed head of the outreach programme of the Rwanda Agricultural Board.

This placed him at the helm of taking all agricultural and associated technologies to farmers. Staring him in the face were 24 technologies ready and waiting to be transferred to farmers. Leonidas and his team have created Innovation Platforms for Technology Adoption, which are aiding technology transfer.

Gafishi Kanyamasoro, Rwanda

Gafishi is in charge of maize breeding. His task is to develop inbred lines of maize for all high-altitude areas in Rwanda. Currently, Rwanda is importing hybrid maize for high altitude from Kenya. But the government wants inbred varieties adapted to the Rwandan highlands to be developed urgently to propel increased maize production. Gafishi is also breeding to develop a farmer-preferred, white open-pollinated variety from the only variety adapted for the highlands, which unfortunately, the farmers do not like because it is yellow. Rwanda has an acute shortage of maize breeders—currently there are only three. Gafishi did MSc studies in Plant Breeding at Makerere University.

Cyamweshi Rasangama, Rwanda

Upon returning to the Rwanda Agricultural Board in early 2011, Cyamweshi was appointed a researcher in soil conservation. He had just completed his MSc in soil science at Makerere University. He currently works as a Director of Nutural Resources Management NRM in RAB and is tasked with initiating research in soil conservation and formulating fertilizer use recommendations for priority crops: maize, wheat, rice, potato and beans. A junior researcher before he was empowered, Cyamweshi now has a cocktail of research milestones directly linked to his name.“I can now do any form of research, and when I interact with researchers the world over, I feel comfortable,” he notes.

Wilson Dufitumukiza, Rwanda

Wilson is the Head of the National Tea Research and Extension Programme for Rwanda. This puts him at the helm of promoting public–private partnerships nationally, regionally and internationally to improve tea production and conservation. He is responsible for ensuring that technical capacity is boosted for tea research and development. He is also involved in formulating tea policy and strategy. Before earning his MSc in Soil Science at Egerton University, Wilson was an assistant researcher.

Uwizerwa Mathilde, Rwanda

Mathilde is now head of the National Soybean Programme in Rwanda. Her tasks are to conduct research and extension in soybean. This means she leads efforts to produce quality soybean, promote soybean inoculated through farmer field schools and link farmer cooperatives to soybean oil processors. "My thesis, Co-deployment of legume-nodulating bacteria and arbuscularmycorrhizae fungi for improved bean in acid soil, was spot on to our current production challenges," she notes.

Maximillan Manzi, Rwanda

Maximillan was appointed Director of Livestock Research and Extension in Eastern zone, putting him at the top of the livestock sector in Rwanda. "I monitor and coordinate the activities of 26 livestock staff engaged in livestock nutrition, health and breeding," he notes. "I champion research into reproduction physiology for indigenous cows and cattle genotypes in Rwanda, conduct research on embryo transfer and artificial insemination, and maintain a system for collecting, documenting and analysing goat and cattle breeding data." Maximillan owes it all to the MSc in Range Management that he did at the University of Nairobi in Kenya.

Nepomusecene Ntukamazina, Burundi

In July 2012, Nepomusecene was appointed in-country representative of the Bean Innovations Project funded by ASARECA. But this was only the beginning. In September 2012, he was appointed to assist the overall boss, the Director General of ISABU, in managing the research component of a five-year programme funded by the Belgian and Burundian governments. Worth 5 million euros, the research component covers research, infrastructure, equipment and foundation, and breeder seed development. This assignment has placed him in charge of planning, coordination and facilitating scientists to implement activities under the project. "I have developed tools to facilitate the programme to take off, I have disbursed funds and I carry out monitoring and evaluation,"Nepomusecene explains. Before earning his MSc in research methods at Jomo Kenyatta University of Science and Technology, he was just like any junior scientist—limited!

Michelin Inamahoro, Burundi

When Michelin returned to Burundi in 2011after completing an MSc degree in plant breeding and seed systems at Makerere University, she was appointed head of the National Biotechnology Laboratories and Screen Houses. Under a project funded by the Belgian Technical Corporation, she was also allocated funds to collect samples of potato countrywide and to characterize samples of taro (colocase) countrywide for diseases and other stress factors. "I have initiated research activities in the laboratories to come up with disease-free coffee varieties. I have already set up banana experiments in the laboratories and I am in the process of evaluating CIP (the International Institute for Potato Research) potato varieties for disease-free Irish potato seed, "Michelin explains. "Besides, I have evaluated sweet potato varieties and produced plantlets and handed them over to the potato programme of my institute."

Cyrille Mbokihankuye, Burundi

Cyrille is Head of the Climate Change Programme in ISABU. He is also working on the African Indigenous Vegetables Project to produce quality vegetable seeds and to link farmers to markets. Cyrille has exhibited exemplary performance in evaluating cowpea, tomato and cabbage varieties for drought tolerance in semi-arid areas. This performance is credited to his research on the "Effects of pruning of selected determinate tomato lines on yield and quality" at Sokoine University of Science and Technology.

Fulgence Niyongabo, Burundi

In 2011, upon his return from Makerere University where he had undertaken an MSc in plant breeding and seed systems, Fulgence was appointed team leader for rice research. In this position, he is charged with collaborating with other research entities such as the International Livestock Research Institute in Burundi and the University of Burundi, two institutions with whom he shares knowledge and varieties. "I consider myself the most experienced rice scientist in ISABU. I lead a team of three researchers and seven technicians. Our key role is to release rice varieties that answer the questions of quality, yield and tolerance to other stresses," he says.

Gloriose Habonayo, Burundi

Gloriose is involved in fruit and legume research and crop–livestock integration activities. She is actively contributing to protocol elaboration on improving the quality of organic manure, and improving bean production using the highly nutritious weed *Tithoniadiversifolia*. This plant, available in large quantities in Burundi, is useful in maize and bean production because it is rich in nitrogen, calcium and potassium. Gloriose did her MSc in crop science, specializing in agronomy, at Sokoine University of Science and Technology.

Conclusion

It is only two years since these scientists completed their MSc degrees. Considering the strategic nature of assignments that their countries have entrusted them with, there is no better way to explain the dire need for capacity development in some ASARECA countries.

Annexes

STATEMENT OF MANAGEMENT'S RESPONSIBILITY FOR THE YEAR ENDED 31 DECEMBER 2013

The management of ASARECA is required to prepare financial statements which give a true and fair view of the state of affairs of the Association as at the end of the financial year and of the operating results of ASARECA for that year. Management is also required to ensure that the Association keeps proper accounting records which disclose with reasonable accuracy at any time the financial position of ASARECA. They are also responsible for safeguarding the assets of the Association.

The Management is responsible for the preparation and fair presentation of the financial statements in accordance with Section 4: Financial Management Policies & Guidelines as contained in the ASARECA Operations Manual (Version 1.0, 17 December 2009) and for such internal controls as the management determine are necessary to enable the preparation of financial statements that are free from material misstatement, whether due to fraud or error.

Management accepts responsibility for the annual financial statements, which has been prepared using appropriate accounting policies supported by reasonable and prudent judgements and estimates, in conformity with the Financial Management Policies & Guidelines (Section 4) of ASARECA Operations Manual as required. Management is of the opinion that the financial statements give a true and fair view of the state of the financial affairs of ASARECA and its operating results. Management further accepts responsibility for the maintenance of accounting records which may be relied upon in the preparation of the financial statements, as well as adequate systems of internal financial control.

Nothing has come to the attention of the directors to indicate that the Association will not remain a going concern for at least the next twelve months from the date of this statement.

The accompanying financial report is based on an audit by the independent audit firm of Ernst & Young and signed on behalf of ASARECA by the Executive Director and Head of Finance.

The financial statements were approved by the Board of Directors on ……April……15……and signed on its behalf by:

_____ _____

Executive Director Head of Finance

INDEPENDENT AUDITORS' REPORT TO THE BOARD OF DIRECTORS OF ASARECA

We have audited the accompanying financial statements of The Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA), which comprise of the statement of financial position as at 31 December 2013, and the statement of revenue and expenditure, statement of changes in fund reserves and statement of cash flows for the year then ended, and a summary of significant accounting policies and other explanatory information as set out on pages 11 to 31.

Directors' responsibility for the financial statements

The Association's directors are responsible for the preparation and fair presentation of these financial statements in accordance with ASARECA Financial policies and procedures and in the manner required by the donors, and for such internal control as the directors determine is necessary to enable the preparation of the financial statements that are free from material misstatement, whether due to fraud or error.

Auditors' responsibility

Our responsibility is to express an opinion on these financial statements based on our audit. We conducted our audit in accordance with International Standards on Auditing. Those standards require that we comply with ethical requirements and plan and perform the audit to obtain reasonable assurance as to whether the financial statements are free from material misstatement.

An audit involves performing procedures to obtain audit evidence about the amounts and disclosures in the financial statements. The procedures selected depend on our judgment and include an assessment of the risks of material misstatement of the financial statements, whether due to fraud or error. In making those risk assessments, we considered internal controls relevant to the association's preparation and fair presentation of the financial statements in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the entity's internal control. An audit also includes evaluating the appropriateness of accounting policies used and the reasonableness of accounting estimates made by directors, as well as evaluating the overall presentation of the financial statements.

We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our audit opinion.

Opinion

In our opinion, the accompanying financial statements present fairly, in all material respects, the financial position of Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA) as at 31 December 2013 and of its income and expenditure and cash flows for the year then ended, in accordance with the accounting policies described in Note 1 of the financial statements.

Signed by.....

April 29th, 2014

Ernst & Young
Certified Public Accountants of Uganda

STATEMENT OF FINANCIAL POSITION AS AT 31 DECEMBER 2013

	Notes	2013 US$	2012 US$
ASSETS			
Non-current Assets			
Property and Equipment	2	170,980	192,978
Leased Land	3	310,325	331,012
		481,305	**523,990**
Current Assets			
Cash at Bank	4	10,150,617	5,741,676
Accounts Receivable - NARI Membership	5 (a)	136,081	181,000
Accounts Receivable - Donors	5 (b)	286,198	130,723
Accounts Receivable - Project Sub-grantees	5 (c)	582,868	3,396,264
Accounts Receivable - Others	5 (d)	38,913	5,091
		11,194,677	**9,454,754**
Total Assets		**11,675,982**	**9,978,744**
RESERVES AND LIABILITIES			
Capital Reserves			
Investment in Fixed Assets	6 (a)	481,305	523,990
Capital Reserve Fund	6 (b)	851,985	713,245
Accumulated Operating Surplus	6 (c)	3,543,243	3,517,311
		4,876,533	**4,754,546**
Liabilities			
Deferred Income	7 (a)	5,397,205	4,390,138
Accounts payable - Others	7 (b)	797,129	224,733
Accruals and Provisions	7 (c)	605,115	609,327
		6,799,449	5,224,198
Total Reserves and Liabilities		**11,675,982**	**9,978,744**

The Financial Statements were approved by the Board of Directors on April 14th.....2014 and were signed on its behalf by:

Executive Director ..... Head of Finance .....

STATEMENT OF REVENUE AND EXPENDITURE FOR THE YEAR ENDED 31 DECEMBER 2013

	Notes	2013 US$	2012 US$
REVENUE			
Income from donations	8 (a)	21,993,489	13,366,932
Membership Contribution	8 (b-i)	55,000	55,000
Other earned income	8 (b-ii)	109,672	268,660
Total revenue		**22,158,161**	**13,690,592**
EXPENDITURE			
Governance & Secretariat management	9(a)	3,592,132	2,458,571
Programme management support	9(b)	3,688,946	2,917,803
Technical programmes	9 (c)	14,712,411	7,990,558
Total expenditure		**21,993,489**	**13,366,932**
SURPLUS FOR THE YEAR		**164,672**	**323,660**

The Financial Statements were approved by the Board of Directors on April 14th 2014 and were signed on its behalf by:

Executive Director .....

Head of Finance .....

STATEMENT OF CHANGES IN FUND RESERVE FOR THE YEAR ENDED 31 DECEMBER 2013

	Investment in fixed asset	Capital Reserve Fund	Accumulated Operating surplus	Total Fund Reserve
	US$	US$	US$	US$
At 1 January 2012	**203,407**	**920,216**	**3,317,693**	**4,441,316**
Fixed asset acquisitions in the year	101,673	-	-	101,673
Utilisation of reserve*	331,013	(331,013)	-	-
Sales proceeds	-	11,939	(11,939)	
Surplus for the year	-	-	323,660	323,660
Capital charge transferred to capital fund	-	112,103	(112,103)	-
Depreciation charge for the year	(112,103)	-	-	(112,103)
At 31 December 2012	**523,990**	**713,245**	**3,517,311**	**4,754,546**
At 1 January 2013	**523,990**	**713,245**	**3,517,311**	**4,754,546**
Fixed asset acquisitions in the year	96,055	-	-	96,055
Surplus for the year	-	-	164,672	164,672
Capital charge transferred to capital fund	-	138,740	(138,740)	-
Depreciation charge for the year	(118,052)	-	-	(118,052)
Amortisation charge for the year	(20,688)	-	-	(20,688)
At 31 December 2013	**481,305**	**851,985**	**3,543,243**	**4,876,533**

*In 2012, part of the capital reserve fund (US$ 331,013) was utilised to purchase leasehold land for the construction of the Secretariat head office in Entebbe.

Annex 2: ASARECA Board of Directors

The list reflects information up to 31 December 2013

Director Generals of Agricultural Research

Dr Fidelis Myaka (Board Chair), Division of Research and Development, Ministry of Agriculture, Tanzania

Dr Dieudonne Nahimana (1st Vice-Chairman), Institut de Sciences Agronomiques du Burundi

Dr Fentahun Mengistu (2nd Vice Chairman), Ethiopian Institute of Agricultural Research

Dr Daphrose Gahakwa (Chairperson Programme Committee), Rwanda Agriculture Board

Prof. Paul Mafuka (Chairperson, Finance Committee), Institut National pour 1' Etude et la Recherche Agronomiques, Democratic Republic of Congo

Dr Iyassu Ghebretatios (Chairperson, Audit Committee), National Agricultural Research Institute, Ministry of Agriculture, Eritrea

Dr Aime Lala Razafinjara, Centre National de Recherche Applique au Developpement Rural, Madagascar

Dr Ibrahim El-Dukheri, Agricultural Research Corporation Sudan

Dr Ephraim Amiani Mukisira, Kenya Agricultural Research Institute

Mr Cirino Oketayot, Ministry of Agriculture, Forestry, Cooperatives and Rural Development Juba- South Sudan

Dr Emily Twinamasiko (RIP), National Agricultural Research Organization, Uganda

Stakeholder representatives

Mr Zubeir Ibrahim Mohammed (Private sector), Nile Sun Enterprises, Sudan

Prof. Lilia R. Rabeharisoa (University representative) - Madagascar

Dr Jimmy Smith (CGIAR representative) ILRI, Kenya

Dr Theogene Rutagwenda (Extension representative), Rwanda Animal Resources Development Authority, Rwanda

Mr Richard Sahinguvu (NGO representative), Inades Formation Burundi

Mr Stephen Muchiri (Farmers' representative), Eastern Africa Farmers Federation (EAFF), Kenya

Mr Chungu Mwila (COMESA representative) - COMESA Secretariat, Zambia

Mr Andrea Ferrero (Development partner representative), Delegation of the European Union to Uganda

Annex 2: ASARECA National focal persons

The list reflects information up to 31 December 2013

Ms Nimpagaritse Devote, Institut de Sciences Agronomiques du Burundi

Prof. Mondjalis Poto, Inational Institute for Agricultural Research Democratic Republic of Congo

Mr Asmerom Kidane, National Agricultural Research Institute, Eritrea

Mr Mekonnen Hailu, Ethiopian Institute of Agricultural Research

Dr Foustine P. Wandera, Kenya Agricultural Research Institute

Mr Rakotomamonjy Simeon, National Centre to Applied Research for Rural Development, Madagascar

Dr Vicky Ruganzu, Rwanda Agriculture Board

Mr Victor Silvano, Ministry of Agriculture, Forestry, Cooperatives and Rural Development, Juba, South Sudan

Prof. Kamal El-Siddig, Agricultural Research Corporation, Sudan

Dr Hussein Mansoor, Division of Research and Development, Ministry of Agriculture, Tanzania

Dr Imelda Kashaija, National Agricultural Research Organization, Uganda

Annex 2:ASARECA Staff lists

The list reflects information up to 31 December 2013

1.Office of the Executive Director

Dr Opio Fina, Executive Director

Mr Kyebagadha John, Internal Auditor

Ms Mubiri Flavia, Executive Assistant to Executive Director

Mr Mpirirwe Mark, Assistant internal Auditor

Ms Babirye Dianah, Messenger/Cleaner

Mr Musoke John, Gardener

Office of the Deputy Executive Director

Prof. Wachira Francis, Deputy Executive Director

Ms Basemera Jolly, Programme Assistant

Mrs Lukwago Fatuma, Administrative Assistant

Mrs Muhimbura Apophia, Environmental & Social Safeguards Specialist

Ms Sanyu Jessica, Messenger/Cleaner

2. Programmes

Staple Crops

Dr Rwomushana Ivan, Manager

Dr Isabirye Brian, Programme assistant

Ms Namara Sylvia, Administrative assistant

High Value Non-Staple Crops

Dr Masuki Kenneth, Manager

Mrs Katafiire Maureen, Programme assistant

Livestock and Fisheries

Dr Ndikumana Jean, Manager

Dr Zziwa Emmanuel, Programme assistant

Agro-biodiversity and Biotechnology

Dr Mugoya Charles, Manager

Mr Masiga Clet, Programme assistant

Ms Namuli Annet, Administrative Assistant

Ms Nakimbugwe Janet, Messenger/Cleaner

Natural Resources and Biodiversity

Dr Mogaka Hezron, Manager

Policy Analysis and Advocacy

Dr Waithaka Michael, Manager

Ms Kyotalimye Miriam, Programme assistant

Ms Nankinga Ruth, Administrative Assistant

Ms Anyango Beatrice, Messenger/Cleaner

Knowledge Management & Upscaling

Dr Kimenye Lydia, Manager

Mr Odeke Moses, Program assistant

East African Agricultural Productivity Program

Mr Akulumuka Vincent, Manager

Ms Emeetai Janet, Administrative Assistant

3. Units

Partnerships & Capacity Development

Dr Methu Joseph, Head of Unit

Mrs Mugisha Doris, Programme assistant

Ms Nagiita Victoria, Administrative assistant

Monitoring and Evaluation

Mr Warinda Enock, Senior Technical Officer

Mr Mugumya Roland, Programme assistant

Gender Mainstreaming

Mrs Chiche Yeshi, Gender Expert

Mrs Muhebwa Adeline, Programme assistant

Communication and Public Relations

Ms Nyagahima Jacqueline, Head of Unit

Mr Ilakut Ben, Publications Officer

Mr Wamanga Peter, Web / Rails Info master

Information and Communication Technology

Mr Muga Tom, Head of Unit

Mr Mwesige Daniel, Systems Administrator

Finance

Mr Owere Patrick, Head of Unit

Mr Onama Felix, Senior Accounting Officer

Mrs Komuhangi Christine, Accounting Officer

Mr Kabasi Robert, Senior Accounting Assistant

Mr Jjombwe Paul, Project accountant

Ms Mbabazi Esther, Assistant accountant

Mr Mumbya Moses, Accounts Clerk

Ms Zainab Sanyu, Accounts Clerk

Ms Nalumansi Cissy, Accounts Clerk

Head of Human Resources and Administration

Mr Mukuriah Nelson, Head of Unit

Ms Namuzibwa Racheal, Senior Administrative Assistant

Mr Ssekyanzi William, Driver

Mr Musoke Sulaiman, Driver

Mr Ochom Samuel, Driver

Ms Nnabaggala Christine, Messanger/Cleaner

Mr Embatia Juma, Gardener

Procurement and Contracting

Mr Itaza Muhiirwa, Procurement and Contracting Officer

Mr Aliau John Peter, Procurement assistant

Annex 3: List of selected agricultural technologies, innovations and management practices (TIMPs) generated and promoted by ASARECA under the 1st Operational Plan, 2008 -2013

1.	ALLGRAIN food extruder
2.	Analytical framework identifying institutional barriers
3.	Antibody based diagnostics for CBSV
4.	Appropriate protocols for making ready-to-drink mango, mixed passion fruit and mango-plus-pineapple
5.	juices
6.	Appropriate protocols for making ready-to-drink passion fruit juice
7.	ASARECA drought tolerant gene (s)
8.	ASARECA dryland development domains and investment options
9.	Backcross seeds of Ochuti, a farmer-preferred sorghum variety in Kenya with Striga resistance QTL introgressed
10.	Banana ripening technology
11.	BC2F1 generation with Strigaresistance QTL
12.	Bean stakes innovations
13.	Bean variety - AND10, or Bishaza
14.	Bean variety –G13607
15.	Bean variety - VCB81013
16.	Biogas innovation in Serengeti Mara Ecosystem
17.	bird watching innovation in Serengeti Mara Ecosystem
18.	Clitoria and lablab seed production under irrigation system
19.	Community based macro-propagation technology for multiplication of clean banana planting material
20.	Community-based improved soil-water conservation tillage practices and agro-meteorological advisory service for increasing water productivity
21.	Community conservancies innovation in Serengeti-Mara ecosystem
22.	Community eco-lodges and campsite innovations in Serengeti Mara Ecosystem
23.	Community museums innovation in Serengeti Mara Ecosystem
24.	Conservation agriculture (minimum tillage with cover crops and drought tolerant maize varieties)
25.	Cover crops as a complement to crop residue in natural resource management
26.	Crop residue utilization for soil productivity improvement
27.	Cryopreservation protocols for cassava and sweet potato
28.	Decapitation technique
29.	Development of effective policies for Payment for Environmental Services (PES)
30.	Diagnostic tool for Napier stunt detection
31.	DNA based tool for detection of viral diseases in sweet potato
32.	Diagnostic tool for Napier stunt detection
33.	Drip irrigation and manure application for vegetable and fodder production
34.	East African standard (EAS) 738: Fresh sweet cassava – specification
35.	East African standard (EAS) 739: Dried cassava chips-specification
36.	East African standard (EAS)740: Cassava flour-specification
37.	East African standard (EAS)741: Cassava wheat composite flour- specification
38.	East African standard (EAS)742: Food grade cassava-specification
39.	East African standard (EAS)743: Cassava crisps - specification
40.	East African standard (EAS)744: Cassava and cassava products - Determination of total Cyanogens - Enzymatic assay method
41.	East African standard (EAS)745: Potato crisps – specification
42.	East African standard (EAS) 746: Frozen potato chips-specification
43.	East African standard (EAS)747: Fried potato chips-specification

44.	East African standard (EAS)748: Fresh (ware) potato-specification
45.	East African Standard: Bread -Specification
46.	East African Standard: Reduction of *acrylamide* in potato products -code of practice
47.	Enhancing crop residue utilization in crop-livestock farming system
48.	F1 mapping populations for detection of quantitative trait loci (QTL) associated with resistance to cassava brown streak disease (CBSD) and a SNP-based genetic linkage map.
49.	Feeds conservation using available feed resources
50.	Fine mapping of QTLs associated with Striga resistant genes in Sorghum
51.	Fodder bank intercrops as dairy cattle feed resources
52.	Free range poultry farming innovation in Serengeti Mara Ecosystem
53.	Game bird rearing and licensed game bird hunting innovation in Serengeti Mara Ecosystem
54.	Incorporation of single stem removal and suspension of use of cutting tools in cultural control of Banana *Xanthomonas* Wilt (BXW)
55.	Improved banana juice processing
56.	Improved forage chopper
57.	Improved livestock husbandry innovation in Serengeti Mara Ecosystem
58.	Incorporation of single stem removal and suspension of use of cutting tools in cultural control of Banana Xanthomonas Wilt (BXW)
59.	Integrated technological package for increasing rice production and productivity
60.	Kenyan FPSV Ochuti with Striga resistant QTLs introgressed in BC3F1 and BC3F2
61.	Linkage map of (N13X E36-1) based -RIL populations
62.	Livestock feeds database and livestock feed tables. Emma to refine the title
63.	Low cost feeding packages for dairy production
64.	Management practices for reducing incidence of Napier stunt disease
65.	Mapping vulnerability of climate variability on agriculture systems
66.	Meat roasting stove
67.	Model for valuation of landscapes for watershed management
68.	Modified bee keeping practice innovation in Serengeti Mara Ecosystem
69.	Napier grass genotypes tolerant to stunt and smut disease
70.	Normal and nutritionally-enhanced highland maize varieties
71.	Nutrient feed blocks
72.	Optimal phosphate rate for lablab yield and marginal rate of return
73.	Organic farming innovation in Serengeti Mara Ecosystem
74.	Pen-side diagnostic kit for *Taenia solium* in Pigs
75.	Processing and utilization of *Prosopis juliflora* pods
76.	Protocols for making ready-to-drink fruit juice and bars
77.	Rumen liquor as *inoculum* for in-vitro gas production technique for feed evaluation
78.	Small seed plot technology for seed potato production
79.	Snap beans varieties (new)
80.	Soil and water management technologies and drought tolerant maize varieties
81.	SSR marker for fine mapping of Quantitative Trait Loci (QTLs) associated with Striga resistant genes in sorghum
82.	Striga resistant Sorghum lines - ASAECAT1, ASARECAW2, ASARECAAG3, ASARECAAG4
83.	Sustainable Land Management bye-law development and implementation in Uganda
84.	Sustainable Land Management bye-law development and implementation in Ethiopia
85.	*Teania solium* recombinant vaccine against *Teania solium* in Pigs
86.	Use of crop residues to improve grain yields
87.	Use of drought-tolerant and Striga-resistant sorghum and pearl millet varieties combined with moisture conservation, right time of planting and optimal fertilizer application
88.	Use of Striga-resistant sorghum varieties with fertilizer and water harvesting technologies
89.	Weather-based agro-advisory
90.	Woodlots and domestication of medicinal plants innovation in the Serengeti Mara Ecosystem

Celebrating the impacts

ASARECA
Transforming Agriculture for Improved Livelihoods

www.asareca.org

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