Innovative climate-resilient technologies developed specifically for Mopti, Mali, were implemented in 458 ha to demonstrate that climate change adaptation is achievable. Key to it was merging appropriate local expertise with science-led interventions.

Interventions such as the development of a community-based agro-meteorological forecast system including crop-recommendation bulletins; sharing of information through various media; introduction of climate-smart crop technologies suited to the region; and development of Technology Parks for diffusion of these innovations, are aimed at creating a climate resilient agricultural sector in Mopti.

**Agro-meteorological forecast system**

This system enables farmers to collect weather information. Decadal crop-recommendation bulletins are produced by local level technical services and shared over local radio reaching approximately 190,000 people.

This activity included more than 100 institutions and formal groups that have been involved in agro-meteorology activities at different levels.

**Information sharing**

Besides sharing of primary information, knowledge sharing happened through platforms that included science and technical service providers, farmers, herders, fisher folk and decision makers. Information is also shared through systems enabling stakeholders to provide community level recommendations and influence decision making through village planning meetings, farmers’ local committees, and farmers’ councils.

**Capacity building**

A key aspect of developing endogenous resilient capacities was capacity development for crop, agroforestry and crop-livestock cycle technologies. These were based on locally driven needs and applied local adaptation approaches that were tailored for a single commune or village.

In the crop sector, the training included both innovative horticulture systems and dryland cereals technologies such as improved varieties, soil fertility management, and crop/legume systems.
Developing a climate resilient... from page 1

Crop and livestock systems have been supported by the improvement of fodder cropping and with the implementation of fodder banks.

In agroforestry systems, the training included a wide range of technologies including grafting, tree food banks, exclusion of areas from direct production to rehabilitate degraded land, and farm-based natural regeneration.

To support innovation diffusion Technology Parks have been created and improved practices have also been tested by farmers in their fields. Scientific data is being collected through ‘mother-baby’ trials. Rural Resource Centers for agroforestry production and training have also been set up.

The ‘learning agenda’ approach: One of the main objectives of the project is to develop a learning agenda for smallholder farmers. The learning agenda is a research effort designed to inform the United States Agency for International Development (USAID) projects about how to build a more effective climate resilient agricultural sector in Mopti. The learning agenda focuses on a learning process stimulating education, changing, and adapting to climate change.

What it does: It sets the foundation of the entire capacity development process. All actors and stakeholders can have a clearer understanding of the ongoing capacity development, facilitating partnerships and collaborations in the context of climate change.

The approaches

Bottom-Up learning approach: Information from the agro-ecological and socio-economic setting allows researchers and practitioners to depict the specifics – adaptation successes, endogenous resilience processes, and the needs of a specific community or zone. The analysis (under publication) depicts the existence of a multiple set of agro-ecosystems functions that include food production and a variety of environmental services management of the territory and its conservation, employment, human resources and work, local investment potential, and animal management.

Amalgamating local knowledge with technical and scientific innovations: This approach is adopted to develop endogenous resilient capacities to cope with changing climate. It includes the development of strong community linkages to take collective action and generate internal answers to common issues. To undertake these actions, a wide set of community development activities were put in place such as community group discussions, focus groups, early warning system committees repeatedly visiting the project area during the cropping season, and local-level innovation debate groups. This involved the participation of all potential actors including farmers, civil society institutions and private sector.

In addition, community awareness was raised and facts and figures about climate change were widely diffused through media, film screenings, teacher sketches, exchange visits, etc. In this context, some of the methods such as screening short films through pico projectors and teacher sketches were not only cost effective but also had a high impact.

The project trained 8,580 individuals, of which 36% were women, through the Farmer Field School approach. The systems approach adopted ensured that the adoption level was high.

Field visit to an agroforestry food bank managed by the women group in Toroli village.

Photo: M Petri, ICRISAT

Project: Disseminating learning agenda on resilient-smart technologies to improve the adaptive capacity of smallholder farmers in Mopti
Investor: United States Agency for International Development (USAID), Accelerated Economic Growth Program (Add on), Global Climate Change (GCC)
Partners: The World Agroforestry Centre (ICRAF), Aga Khan Foundation, World Vision Mali and ICRISAT
CGIAR Research Program: Climate Change, Agriculture and Food Security (CCAFS)
Finger millet can play a key role in fighting malnutrition and bringing down the numbers of malnourished children under five years of age.

“Finger millet is high in calcium, zinc and iron. Hence it is good for children, young women and breast-feeding mothers. It possesses important amino acids, which help fight malnutrition and degenerative diseases,” said Dr Rhoda Nungo, Food Nutritionist, Kenya Agricultural and Livestock Research Organization (KALRO) - Alupe Research Centre, Busia. She was speaking at a training program led by ICRISAT.

By working in synergy with the Beyond Zero Campaign spearheaded by the First Lady of Kenya, HE Margaret Gakuo Kenyatta, the level of malnourished children under the age of five can be reduced from the current 30% to 15% or less, she said.

The Beyond Zero Campaign targets infants, pregnant women, breast-feeding mothers and children below five years with the goal of reducing food insecurity and eliminating maternal deaths.

Dr Rhoda also stressed on imbibing healthy eating habits in order to fight hidden hunger, malnutrition and disease. She said it can be achieved by promoting consumption of smart foods like sorghum, finger millet and groundnuts that have high nutritional benefits. Groundnuts contain heart-friendly fats, have a high concentration of antioxidants and are a good source of folates and vitamins. Finger millet besides being good for children and mothers is good for the elderly and diabetics as it takes longer to digest and glucose is released slowly into the blood. Sorghum too has high nutritional value, with high levels of unsaturated fats, protein, fiber and minerals like phosphorus, potassium, calcium and iron.

At the inaugural session, Mr Daniel Otwani, Research Assistant, ICRISAT, outlined the objectives of the training which include:

- Improved crop production practices in sorghum, finger millet and groundnuts;
- Community-based high quality seed production, storage and distribution;
- Value addition, diversified food uses and nutritional benefits of sorghum, finger millet and groundnuts;
- Crop cut techniques for yield estimation; and
- Forum for knowledge and experience sharing between project partners.

Dr Patrick Audi, Project Coordinator, ICRISAT, gave an overview of the Feed The Future-Accelerated Value Chain Development (FTF-AVCD) program. The project goal is enhancing household nutrition and rural economic growth through upgrading of sorghum, finger millet, groundnuts, pearl millet and pigeonpea value chains. It is being implemented by ICRISAT, KALRO, County Governments of Siaya, Busia, Makuengi, Kitui, Elgeyo Marakwet, Tharaka Nthi and Embu.

The five key deliverables of the project are:

- Access to high quality seeds of improved varieties;
- Enhanced productivity and profitability;
- Improved postharvest handling practices;
- Enhanced utilization - value addition,
- Commercialization and diversification of food uses including smart food; and
- Enhanced linkage to product and input markets.

The other key presentations during the training were sorghum agronomy and seed production by Dr Eric Manyasa, Scientist, Cereals Breeding, Dryland Cereals, Kenya; finger millet agronomy and seed production by Mr Otwani and groundnut agronomy and seed production by Mr Boaz Okwiri.

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New publications

Representative Agricultural Pathways and Scenarios for Regional Integrated Assessment of Climate Change Impacts, Vulnerability, and Adaptation


Abstract: The global change research community has recognized that new pathway and scenario concepts are needed to implement impact and vulnerability assessment where precise prediction is not possible, and also that these scenarios need to be logically consistent across local, regional, and global scales (Moss et al. 2008, 2010). For global climate models, representative concentration pathways (RCPs) have been developed that provide a range of time-series of atmospheric greenhouse-gas concentrations into the future (Moss et al. 2008, 2010; van Vuuren et al. 2012a).

For impact and vulnerability assessment, new socio-economic pathway and scenario concepts have also been developed (Kriegler, 2012; van Vuuren et al., 2012b), with leadership from the Integrated Assessment Modeling Consortium (IAMC).

http://oar.icrisat.org/9213/

New Methods to Assess Climate Change Impacts, Vulnerability and Adaptation of Agricultural Production Systems: The Experience of AgMIP's Regional Integrated Assessments in Sub-Saharan Africa and South Asia.

Authors: Valdivia R, Tui SHK, Sridharan S and Antle J

Published: 2015. in: IPCC Experts Meeting on Scenarios, May 18 - 20, 2015, Conference Center Laxenburg, Vienna.

Abstract: The Agricultural Model Inter-comparison and Improvement Project (AgMIP) provides the link between global climate change projections and sector-specific and regional pathways and scenarios (Antle et al. 2015; Rosenzweig et al. 2013). AgMIP, through a trans-disciplinary process involving both scientists and stakeholders, is developing Representative Agricultural Pathways (RAPs) for agricultural systems at both global and regional scales. In addition to climate modeling, RAPs include bio-physical and socio-economic drivers, associated capabilities, challenges and opportunities. RAPs can then be translated as components of the AgMIP Regional Integrated Assessments (RIA) of climate vulnerability and impacts. http://oar.icrisat.org/9207/

Improvement of Basmati Rice Varieties for Resistance to Blast and Bacterial Blight Diseases Using Marker Assisted Backcross Breeding.


Abstract: Marker assisted backcross breeding was employed to incorporate the blast resistance genes, Pi2 and Pi54 and bacterial blight (BB) resistance genes xa13 and xa21 into the genetic background of Pusa Basmati 1121 (PB1121) and Pusa Basmati 6. The Pi2+Pi54 carrying near-isogenic lines (NILs) were effective in combating a pan-India panel of Magnaporthe oryzae isolates with high level of field resistance in northern, eastern and southern parts of India. Alongside, the PB1121-NILs and PB6-NILs carrying BB resistance genes xa13+xa21 were resistant against Xanthomonas oryzae pv. oryzae races of north-western, southern and eastern parts of the country. Three of NILs developed in this study, have been promoted to final stage of testing during kharif 2015 in the Indian National Basmati Trial. http://oar.icrisat.org/9204/

Agronomic Improvements can Make Future Cereal Systems in South Asia Far More Productive and Result in a lower Environmental Footprint.


Abstract: This study was conducted in four locations representing major food production systems of densely populated regions of South Asia. Novel production-scale research platforms were established to assess and optimize three futuristic cropping systems and management scenarios (S2, S3, S4) in comparison with current management (S1).

With best agronomic management practices (BMPs), including conservation agriculture (CA) and cropping system diversification, the productivity of rice- and wheat-based cropping systems of South Asia increased substantially whereas the global warming potential intensity decreased. Positive economic returns and less use of water, labor, nitrogen, and fossil fuel energy per unit food produced were achieved. A comprehensive baseline dataset generated in the present study will allow the prediction of extending benefits to a larger scale. http://oar.icrisat.org/9205/
Yield Gap and Water Productivity Atlas launched for India

India is the latest addition to the Global Yield Gap Atlas that provides important information on the capacities of various countries to be self-sufficient in staple food crop production now and in the future. So far the Atlas has been populated for 24 countries for five major staple crops (maize, wheat, rice, sorghum and millet) and analyses for 25 additional countries is in progress.

“India is a very important addition to the Atlas as the projected grain demand in India is 377 tons by 2050, which is a 42% increase relative to 2015,” said Professor Martin van Ittersum from Wageningen University.

Dr Lieven Claessens, Regional Coordinator for the project in Africa and South Asia at ICRISAT, said, “We engaged in a successful collaboration with the Indian Council of Agricultural Research to collect huge local data and complete the complex analyses for India. However, for now the spatial framework is solely based on biophysical conditions, and we know that adoption of improved technologies does not depend only on biophysical factors. So the next step is to add socioeconomic information like access to input and output markets, farm size, labor availability and off-farm income to better characterize farming systems.”

About the Atlas

Current rates of yield increase for major food crops is not enough to meet demand on existing farmland. Given limited land suitable for crop production and population soon to exceed 9 billion, ensuring food security while protecting carbon-rich and biodiverse rainforests, wetlands, and grasslands depends on achieving highest possible yields on existing farm land. To help agricultural researchers and policy makers prioritize their efforts to sustainably intensify agricultural systems, the Global Yield Gap and Water Productivity Atlas (http://www.yieldgap.org/) is a valuable tool providing answers to important questions like:

- What is the food production potential for a region or country (on existing farm land)?
- Will it be possible for country/region to be self-sufficient in food production by 2030 or 2050 under different climate and socio-economic scenarios?
- What are the causes of yield gaps and how to overcome them? How can we better target options for sustainable intensification?
- What are the regions to target agricultural experimentation and what are potential technology extrapolation domains?

This global project was initiated in 2012 as an international research collaboration between the University of Nebraska, Wageningen University, ICRISAT and National Agricultural Research Systems (NARS) partners in various countries in Africa, Latin America, North America, South Asia, East Asia, Middle East, Oceania and Europe.

The results for India were presented at a workshop on 11 December 2015 in New Delhi.
See http://www.yieldgap.org/india

Project: Global Yield Gap and Water Productivity Atlas
Investor: Bill & Melinda Gates Foundation and USAID.
Partners: University of Nebraska, Wageningen University, ICRISAT, ICAR, CIMMYT, Africa Rice and NARS in 24 countries.
CGIAR Research Program: Climate Change, Agriculture and Food Security (CCAFS)

Participants at the workshop.

Cropping pattern of India (%) (2010-11).
Source: http://www.yieldgap.org/india
Mr Samson Achina, Director of Agriculture, Busia County, who inaugurated the training, lauded the knowledge sharing forum between the different stakeholders and the extension staff from Siaya and Busia Counties, in particular. He encouraged the participants to share their field experiences and challenged them to work towards reducing poverty levels, currently estimated to be 60%, to below 40% in the two counties. He emphasized that FTF-AVCD program should focus on crops that exhibit comparative advantage in household nutrition, productivity and profitability. Furthermore, Kenya has a huge deficit in groundnut production which was an opportunity for farmers and other groundnuts value chain participants in the two counties to enhance their income from improved efficiency in the groundnut value chain. The other guests were Ms Florence Kigunzu, Sub-County Agricultural Officer (SCAO), Matayos Sub-County, Busia County; and Ms Sarah Mango, SCAO, Gem Sub-County, Siaya County.

At the end of training, the participants prepared work plans for implementation on field days for 2015-2016 cropping season that aims to reach about 2,000 farms with information on improved technologies; and scaling up activities for long rains 2016 targeting over 5,000 farmers in each county with seed of finger millet, sorghum and groundnuts. The training was attended by 30 county extension officers from Siaya and Busia Counties.

The training was organized at the Agricultural Training Centre (ATC), Busia on 7-8 January by the Drought Tolerant Crops (DTCs) component of the FTF-AVCD Program for Kenya.

**Project:** Accelerated Value Chain Development Program - Drought Tolerant Crops component  
**Investor:** Feed the Future/USAID  
**Partners:** KALRO-Kenya, County Governments  
**CGIAR Research Program:** Dryland Cereals

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**Welcome**

Mr Shuaibu Abubakar Ummah, a Nigerian national, joined on 4 January as Monitoring and Evaluation (M&E) Specialist, Kano, Nigeria.

Mr Ummah holds an MSc in Agricultural Economics from University of Ibadan. He has over 20 years of work experience in the service of government, non-governmental organizations and externally aided projects in Nigeria, in planning, monitoring, research and evaluation.

We welcome Mr Ummah to Team ICRISAT and wish him all success.

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**Reader’s Comment**

Some years ago, the MS Swaminathan Research Foundation (MSSRF) innovated ‘a whole village pulses’ program in Pudukottai District of Tamil Nadu to showcase the importance of self-sufficiency in pulses production in India, in the context of food and nutrition security. I hope ICRISAT, IIPR, Kanpur, and CRIDA will amplify the spread and productivity of pulses in this International Year of Pulses with farmer-centric programs within the ongoing watershed development programs of the states.

M Velayutham,  
Ex-Director, National Bureau of Soil Survey and Land Use Planning (ICAR) and Ex-Executive Director, MSSRF, Chennai