Ph. N. Palmer (CIAT)

CHANGE FOR THE BETTER

THE CGIAR RESEARCH PROGRAM ON Climate Change, Agriculture and Food Security CCAFS

2015 ANNUAL REPORT

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Correct citation:
CCAFS. 2016. Annual Report 2015: Change for the better. Copenhagen, Denmark: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS). Available online at: bitly.com/ccafs2015

The CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) is a strategic partnership of CGIAR and Future Earth, led by the International Center for Tropical Agriculture (CIAT).

The Program is carried out with funding by CGIAR Fund Donors, Australia (ACIAR), Ireland (Irish Aid), Netherlands (Ministry of Foreign Affairs), New Zealand Ministry of Foreign Affairs & Trade; Switzerland (SDC); Thailand; The UK Government (UK Aid); USA (USAID); The European Union (EU); and with technical support from The International Fund for Agricultural Development (IFAD).

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Cover photo: A farmer in Malawi checks her maize crop that is struggling as a result of the worst drought in three decades. Photo: N. Palmer (CIAT)

ISSN: 1904-402X

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Photo: L. Sebastian (IRRI/CCAFS)

IMPACTS THROUGH POLICIES AND PARTNERSHIPS

India protects its farmers from climate change

India is taking climate change seriously. With tens of millions of lives at risk, the government is looking to new technologies to equip farmers to face the future. CCAFS research is contributing to this mission: Climate-Smart Villages, solar power and an innovative crop insurance scheme are helping farmers in India cope better with a changing climate.

In Haryana, a major agricultural region in the country's north, Climate-Smart Villages have started to spread rapidly. In these villages, the International Maize and Wheat Improvement Center (CIMMYT) together with CCAFS worked with national partners and farmers' organizations to develop and test a range of innovations and technologies. Farmers used climate-smart agriculture practices such as zero-tillage, crop residue management, direct dry seeded rice,

agroforestry and climate information services. When used in the right combination, these practices can save water and energy, and increase farmers' incomes through higher productivity. At the same time they help build resilience to extreme and variable climatic events.

Evidence from the villages, combined with public awareness and dialogue, convinced the Department of Agriculture of the State Government of Haryana to launch a pilot programme of 500 Climate-Smart Villages in the rice-wheat systems districts of the state.

> "The Department of Agriculture in close association with CIMMYT-CCAFS piloted the concept of climate-smart villages in Karnal District ... The results were very useful..." **Dr A.K. Yadav,** Director General Agriculture**, Haryana, Panchkul**

Solar-powered water pumps

Another example of India looking to reduce the effect of climate change is seen in irrigation. In certain areas, climate change will likely bring droughts, but affordable irrigation would reduce its impact. In drought-prone Bihar state, measures such as subsidizing fuel for diesel-powered pumps had proven ineffective because of the scale of the costs involved. But solar-powered water pumps can make irrigation affordable while helping to drought-proof crops, according to research with local farmers. The project was implemented in collaboration with CIMMYT, the International Food Policy Research Institute (IFPRI) and the International Water Management Institute (IWMI).

Scientists presented the research to the Ministry of Finance in pre-budget policy discussions organized by the Chief Economic Advisor to the Minister. Following on from this meeting, the Indian government increased its budget allocation to launch a credit-cum-subsidy scheme to install 10 000 solar pumps across India.

Insuring crops

As well as erratic rainfall, climate change will inevitably cause crops to fail. As a way of reducing the crippling impact of crop failure, about 30 million farmers in India subscribe to crop insurance schemes. Nearly 38% have weather-based index insurance coverage, but the schemes have been unpopular. Farmers often have trouble settling their claims and insurance companies do not like the high transaction costs. The Government of India, however, has expressed a commitment to make crop insurance more accessible to farmers, and index insurance may provide the answer.

Successful index insurance schemes depend on having good rainfall triggers, which indicate when crop growth is likely to begin to suffer and subsequently activate payments to affected farmers. Using several scientific techniques such

as crop and statistical models to examine crop–weather relationships, CIMMYT scientists developed new region- and crop-specific rainfall triggers in Maharashtra state. The state government adopted the new approach to protect several thousand farmers of key crops from the vagaries of the weather. Then several insurance companies, notably AIC of India, applied them to provide rainfall risk cover to the crops of almost 1 million resource-poor, rainfed farmers.

> "The final product is an improvement on what is currently available and attempts to provide a win–win situation for all: farmers, the insurance industry as well as the government." **Pramod K Aggarwal, Program Leader, CCAFS South Asia**

Read more

- CIMMYT Blog: Climate smart villages: local adaption to promote climate smart agriculture
- Kishore A et al. 2014. Droughts, distress, and policies for drought proofing agriculture in Bihar, India. IFPRI Discussion pape
- CCAFS Report. 2015. Maximising farmers' satisfaction with crop insurance: improved WBCIS term-sheets for soybean, cotton, bajra and paddy in Maharashtra
- CCAFS Blog: Better designed weather-based insurance holds promise for Maharashtra farmers

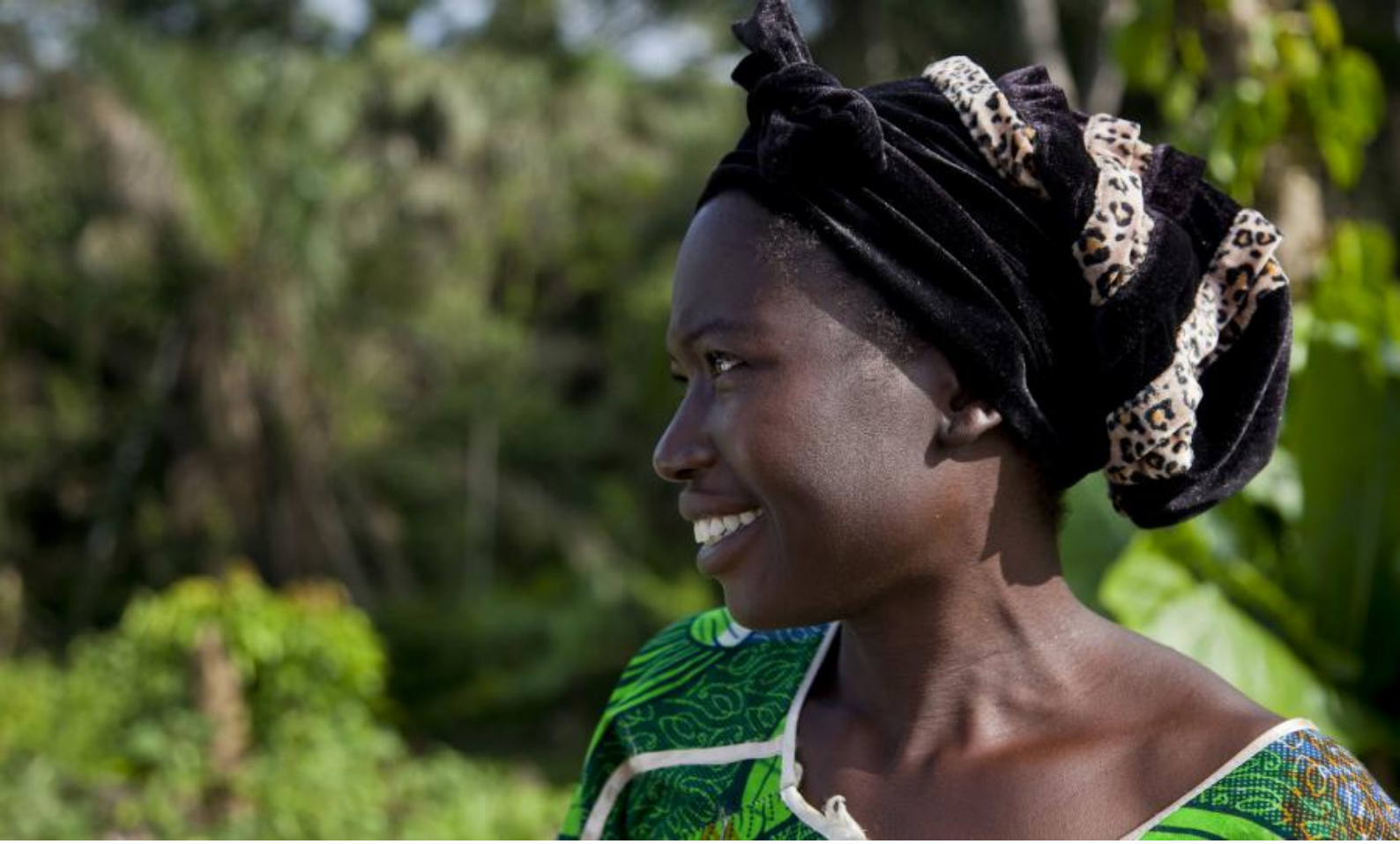

Photo: L. E. Pohl (Bread for the World)

IMPACTS THROUGH POLICIES AND PARTNERSHIPS

Climate-proofing agricultural development in Africa

The potential effects of climate change threaten agricultural systems in Africa, including subsistence agriculture as well as valuable export crops like cocoa. Investments in agricultural development are increasingly vulnerable to climate change and must take climate impacts into account to ensure long-term sustainability. Recognising this, the International Fund for Agricultural Development (IFAD) is increasingly adopting science from the International Center for Tropical Agriculture (CIAT) and CCAFS to guide the introduction of climate-proofing into their project design and implementation.

In 2014, CIAT's successful collaboration with the Government of Nicaragua's Adapting to Markets and Climate Change Project (NICADAPTA) resulted in the adoption of climate-resilient practices such as water efficiency and crop

diversification in the cocoa and coffee sectors in Nicaragua. CIAT climate change models and CIAT maps of suitable regions for continued cocoa and coffee farming were used as underlying research by a variety of stakeholders. As a result, in 2015 CIAT was asked to develop studies that could inform and help prioritise adaptation strategies for agriculture in Liberia, Uganda and Comoros, for eventual use by IFAD through their Adaptation for Smallholder Agriculture Programme (ASAP).

CIAT research was used to help prioritize USD 75 million of public investment in agricultural development in the 3 countries, and to assist in long-range climate-awareness planning.

In Liberia, CIAT research explored projected climate impacts on cocoa, an important cash crop. In addition to exploring likely climate impacts in 30 years, the researchers suggested adaption strategies according to the exposure of specific regions in Liberia. The study's recommendations led to a USD 4.5 million IFAD project adopting interventions such as improved varieties and alternative agricultural practices, to make the cocoa sector more resilient to climate change.

In Uganda, researchers used the CIAT-developed Climate-Smart Agriculture Rapid Appraisal (CSA-RA) Prioritization Tool to provide appraisals of farming systems in four districts. The appraisals offered essential information on current challenges and potential adaptation strategies, as well as recommendations on how to address these. IFAD used this information to design the USD 71 million Restoration of Livelihoods in Northern Uganda (PRELNOR) project, which is being implemented in 6 districts in 2016.

In Comoros, scientists conducted climate and environmental assessments, which fed directly into design of a USD 4 million program IFAD is implementing in 2016.

An independent validation report analysed the impact of CIAT research on IFAD investment decisions. It showed that CIAT-CCAFS climate change research – including the prediction of impacts on specific agricultural sectors like cocoa – has been used by major implementers in the field, such as the World Cocoa Foundation, the World Bank, USAID and World Coffee Research.

> "CIAT's research provided vital information on farming systems, useful for the program design and particularly in defining interventions for scaling out." **Steven Twomolow, IFAD Climate and Environment regional director for East and Southern Africa**

Users of the research indicated that scientists should continue and expand this type of institutional collaboration, which allows partners to co-develop knowledge that is demand-driven and applied.

Read more

- Nyangaga J. 2016. How CIAT's climate research informs and influences decision making in IFAD and the cocoa and coffee sector globally. Outcomes Validation Report
- Schroth G et al. 2015. Vulnerability to climate change of cocoa in West Africa: patterns, opportunities and limits to adaptation. **Science of The Total Environment**. 556: 231–241.
- Schroth G, Läderach P, Martínez-Valle AI, Bunn C. 2015. Climate vulnerability and adaptation of the smallholder cocoa and coffee value chains in Liberia
- Mwongera C, Shikuku KM, Twyman J, Winowiecki L, Ampaire A, Koningstein M, Twomlow S. 2014. Rapid Rural Appraisal Report of Northern Uganda.
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Photo: E. van de Grift

IMPACTS THROUGH POLICIES AND PARTNERSHIPS

Projecting the future to guide today's agriculture, climate and development policies

Developing policies that will meet future challenges requires foresight to predict the situations that need to be met. CCAFS experts and partners have supported the creation of national climate, agriculture and socioeconomic development policies by using the scenarios technique. Scenarios are different 'what-if' accounts of the future that can be told in words, numbers, images, maps and/or interactive learning tools.

In 2015, CCAFS researchers helped formulate a range of agriculture, climate and development policies and plans in Bangladesh, Burkina Faso, Cambodia,

Colombia, Ghana, Honduras, Tanzania and Uganda. Working with experts from the University of Oxford, UK, the CCAFS scenarios team collaborated with various stakeholders to first develop regional scenarios in each country. These were quantified using 2 agricultural economic models: the International Model for Policy Analysis of Agricultural Commodities and Trade (IMPACT) and the Global Biosphere Management Model (GLOBIOM).

IMPACT is a tool developed by the International Food Policy Research Institute (IFPRI) made up of linked economic, water and crop models that assesses the long-term challenges facing policy makers in reducing hunger and poverty in a sustainable way. GLOBIOM, from the International Institute for Applied Systems Analysis (IIASA), is used to analyse competition for land use between agriculture, forestry and bioenergy.

Once the regional scenarios had been agreed upon, the teams worked closely with national stakeholders to rapidly design a process around down-scaled and policy-specific scenarios. The modelling software also allowed policy makers to test their plans against different socioeconomic/climate scenarios. Analysing the draft plans from the perspective of each scenario allowed recommendations to be integrated into the plans to create more robust versions.

> "Here we see rigorous research interfacing directly with policy development. That's groundbreaking." **Dr. Edidah Ampaire, Project Coordinator, International Institute for Tropical Agriculture (IITA), Uganda**

Cambodia's Climate Change Priorities Action Plan, for example, contains scenarios for agriculture and agroforestry, rubber, livestock, forestry and fisheries.

The plan is one of the starting points in mainstreaming climate change into formal development planning, with a budget of almost USD 74 million.

In Honduras, the exercise so improved the draft Climate Strategy that it has also been used to develop a broader government adaptation plan. Participants in a related workshop also expressed an interest in using the same methodology to strengthen other national climate and agriculture plans.

Read more

- CCAFS Blog: Future Scenarios work informs climate and agriculture policies in seven countries
- CCAFS Blog: The future of food security, environments and livelihoods in Western Africa: Four socio-economic scenarios
- CCAFS Blog: Future scenario development now part of Cambodia's Action Plan for Agriculture

- CCAFS Blog: Helping Honduras build a more robust climate adaptation strategy for the agriculture sector

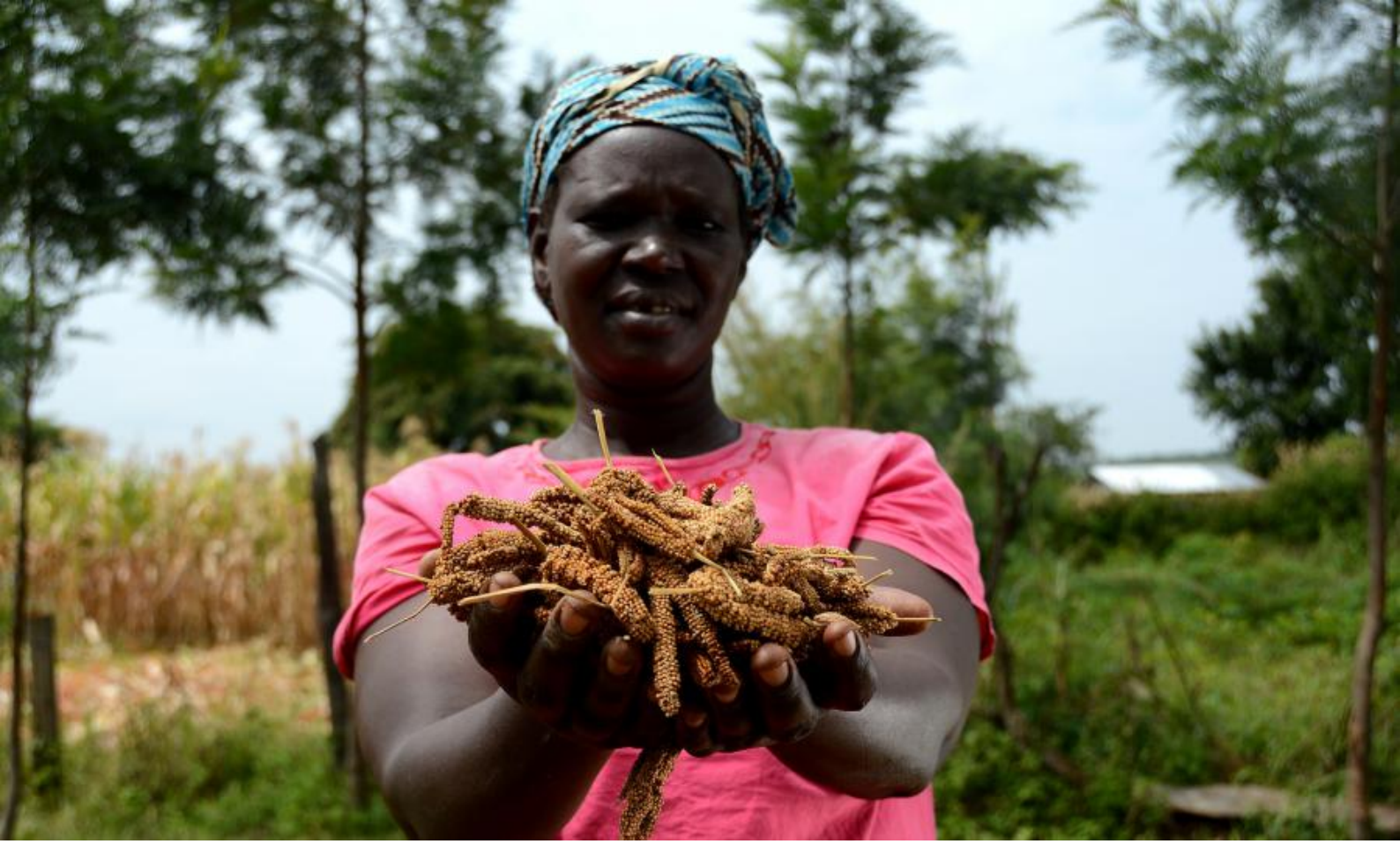

Photo: S. Kilungu (CCAFS)

IMPACTS THROUGH POLICIES AND PARTNERSHIPS

Strengthening the national plans that will deliver the Paris Climate Agreement

The Paris Climate Agreement requires countries to publicly outline what post-2020 climate actions they intend to take. These are known as Intended Nationally Determined Contributions (INDCs). In collaboration with CCAFS, Kenya, Uganda, Tanzania, Costa Rica and Colombia have produced INDCs with strong climate-smart agriculture components.

Well-designed INDCs will allow each country to combat climate change and limit future climate risk. They will also determine whether the world can actually achieve the 2015 Agreement.

CCAFS has been collaborating with a number of countries in this process. Kenya, Uganda and Tanzania developed Climate-Smart Agriculture Framework Programmes (CSA-FPs), with the technical support of CCAFS East Africa and a number of other research partners. CSA-FPs guide investments in climate-resilient and low-carbon agriculture. Kenya's INDC, for example, seeks to reduce the country's greenhouse gas emissions by 30% by 2030. Once finalized, the Framework Programmes were integrated into the national INDCs that were submitted to the United Nations Framework Convention on Climate Change (UNFCCC) in 2015.

Escenarios Cambio Climatico CR_EngSubt from PNUD Costa Rica on Vimeo.

In a broader contribution, the Center for International Forestry Research (CIFOR) and the International Livestock Research Institute (ILRI) led the process of developing 'targetCSA', a tool for prioritizing CSA practices at the county level. This tool allows valuable insights to be made in policy and planning decisions and contributes to the development of CSA-FPs.

Meanwhile, in Colombia, national experts and decision makers in climate change used a scenario-guided approach from CCAFS to develop its INDC. Coming together in a workshop, participants revised current emissions strategies, then created a set of future strategies for different emissions-reduction scenarios up to 2030.

The scenario approach also guided the development of Costa Rica's INDC. Costa Rica's team from the Ministry of Environment and Energy used the CCAFS methodology to start a dialogue among national experts and then define appropriate mitigation measures. This led to the creation of a long-term national vision on emissions reduction in the sectors of agriculture, transport, forests, electric energy and waste. Such discussion was invaluable in completing the INDC in time for submission to the UNFCCC.

> "The scenarios workshop showed that we could have a fruitful and productive discussion about how to reduce emissions." **Franklin Panigua, consultant to the Ministry of Environment and Energy, Costa Rica**

Read more

- CCAFS Blog: Kenya integrates climate-smart agriculture into its Intended Nationally Determined Contribution
- CCAFS Blog: Scenario guided development of Costa Rica's Intended Nationally Determined Contribution

- CCAFS Blog: Colombia's agriculture in the intended nationally determined contribution spotlight
- MINAE Blog: Compromisos ante el Cambio Climático, publicación de estudio de caso Costa Rica

Photo: K. Zaw (Bioversity International)

IMPACTS THROUGH POLICIES AND PARTNERSHIPS

Informing national science and food security strategies in Ghana and Myanmar

Many countries have expressed interest in the concept, approach and procedures are relatively new, making it difficult to know where to start. CCAFS is working with governments to help them to take action. In 2015, CCAFS convened panels of experts in both Ghana and Myanmar to collaborate on developing climate-smart strategies and pathways to reach their country's agriculture goals.

CCAFS science, such as information-gathering techniques and sophisticated data analysis, was used by the Ghana science-policy dialogue platform and the

Ministry of Food and Agriculture (MOFA) to design and implement the National Climate-Smart Agriculture and Food Security Action Plan for Ghana (2016–2020). The action plan is a basis for on-the-ground implementation of climate-smart agriculture in Ghana's agro-ecological zones. CCAFS and the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) supported an inclusive and participatory approach to formulating the framework that will be essential to put the 8 programme areas of the plan into action.

The 8 areas of the agriculture and food security sector

1. Develop institutional capacity for research and development
2. Develop and promote climate-resilient cropping systems
3. Adapt livestock production systems
4. Support climate adaptation in fisheries and aquaculture
5. Support water conservation and irrigation systems
6. Risk transfer and alternative livelihood systems
7. Improve post-harvest management
8. Improve marketing systems

CCAFS also worked closely with the Myanmar Ministry of Agriculture and Irrigation (MOAI), where the International Rice Research Institute (IRRI), together with other research partners, helped to design what became Myanmar's climate-smart agriculture strategy. This strategy will serve as the roadmap for Myanmar's future climate-smart agriculture planning.

> "Without the Myanmar Climate Smart Agriculture Strategy, Myanmar's agriculture sector will not sustain its crop production in the context of climate change." **Dr Myo Kywe, Rector of Yezin Agriculture University**

In both countries, the major output of this collaboration with CCAFS was a framework for implementing climate-smart agriculture. Each country has specific national and regional plans, underpinned by strong climate science. Working within relevant ministries and research institutes in each country, implementation programmes can now be put in place. In Myanmar, pilot Climate-Smart Villages are already being selected.

Both countries used an inclusive, participatory approach to arrive at their strategies, thereby ensuring more buy-in at both the community and national policy level.

Read more

- Essegbey GO et al. 2015. National Climate-Smart Agriculture and Food Security Action Plan of Ghana (2016-2020). Working Paper No. 139

- CCAFS Blog: Myanmar Climate-Smart Agriculture Strategy

Photo: M. Mitchell (IFPRI)

IMPACTS THROUGH POLICIES AND PARTNERSHIPS

Costa Rica, Nepal and Uganda adopt crop diversity policies as part of climate-resilience planning

All countries need access to a constant supply of genetic resources to be able to develop new varieties of crops, especially to meet the challenges of climate change.

The International Treaty on Plant Genetic Resources for Food and Agriculture,

created under the auspices of the United Nations and administered by the Food and Agriculture Organization (FAO), recognizes countries' rights over their genetic resources. The associated Multilateral System of Access and Benefit Sharing promotes the sharing of the germplasm. Through the Multilateral System, countries can share crop genetic diversity for agricultural research and crop breeding. Effectively, the Multilateral System creates a truly global pool of genetic resources for countries' agricultural development and adaptation to climate change.

Scientific support in accessing this system will provide greater opportunities for Costa Rica, Nepal and Uganda to develop new crop varieties that will cope better with projected climate change. Experts from CCAFS assisted national government agencies in Costa Rica, Nepal and Uganda to sign on to the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) and the Multilateral System. Each country generated national policies that facilitate the exchange of genetic resources with other countries belonging to the agreement.

In Costa Rica, CCAFS national partners drafted and negotiated a memorandum of understanding among national agencies after a programme of research, awareness-raising and capacity-building activities. The partners were the National Commission on Plant Genetic Resources (CONAREFI), the Centro Agronómico Tropical de Investigación y Enseñanza (CATIE) the National Institute for Innovation and Transfer of Agricultural Technologies (INTA) and the Ministry of Agriculture.

To reach agreement, Bioversity International staff and national partners produced ground-breaking reports on the importance of genetic resources for Costa Rica's production of food security crops; the dependence of Costa Rica on other countries' genetic resources of these crops; and the potential importance of such genetic resources in assisting with the development of crops that are better adapted to climate change.

In Nepal, partners, including the Nepal Agricultural Research Council (NARC), the Ministry of Agricultural Development (MoAD) and Local Initiatives for Biodiversity, Research and Development (LIBIRD), led the process of revising the National Agrobiodiversity Policy to allow the country to join the System. A series of consultations with ministries and other stakeholders showed how access to material from other countries will become increasingly important for Nepal to adapt to changing climatic conditions. This created the authorizing environment for the Cabinet to approve the new policy and action plan.

In Uganda, CCAFS involvement overcame a policy bottleneck that had existed for many years, where no organization was clearly recognized to have authority to provide access to the country's plant genetic resources. A negotiated agreement among 3 lead agencies defined responsibilities and regulated access to the

resources and benefit sharing. Once that agreement had been reached, national institutions and CCAFS partners, with the support of Bioversity International, prepared Uganda's first list of crop germplasm to be made available through the Multilateral System and notified the Treaty Secretariat accordingly, creating the opportunity for users in Uganda and around the world to access germplasm conserved in Uganda.

> "Uganda has developed a national policy on plant genetic resources for food and agriculture… This has made it easier and clearer for all parties to have access to Plant Genetic Resources for food and agriculture, which is important for climate change adaptation and ultimately for the country's food security." Gloria Otieno, John Wasswa Mulumba and Francis Ogwal, Uganda

Read more

- Estrada Garro F, et al. 2016. The importance of international exchanges of plant genetic resources for national crop improvement in Costa Rica. CCAFS Working Paper No. 153
- Bioversity International Blog: Outputs by GRPI project partners
- Bioversity International Blog: GRPI 2 project starts in the Americas. Kick-off workshop in Costa Rica
- Bioversity International Blog: Securing crop diversity for climate change adaptation: creating policy space for Nepal to participate in the multilateral system of access and benefit sharing
- Bioversity International Blog: Climate analogues for Rwanda and Uganda – building capacity to exploit the multilateral system

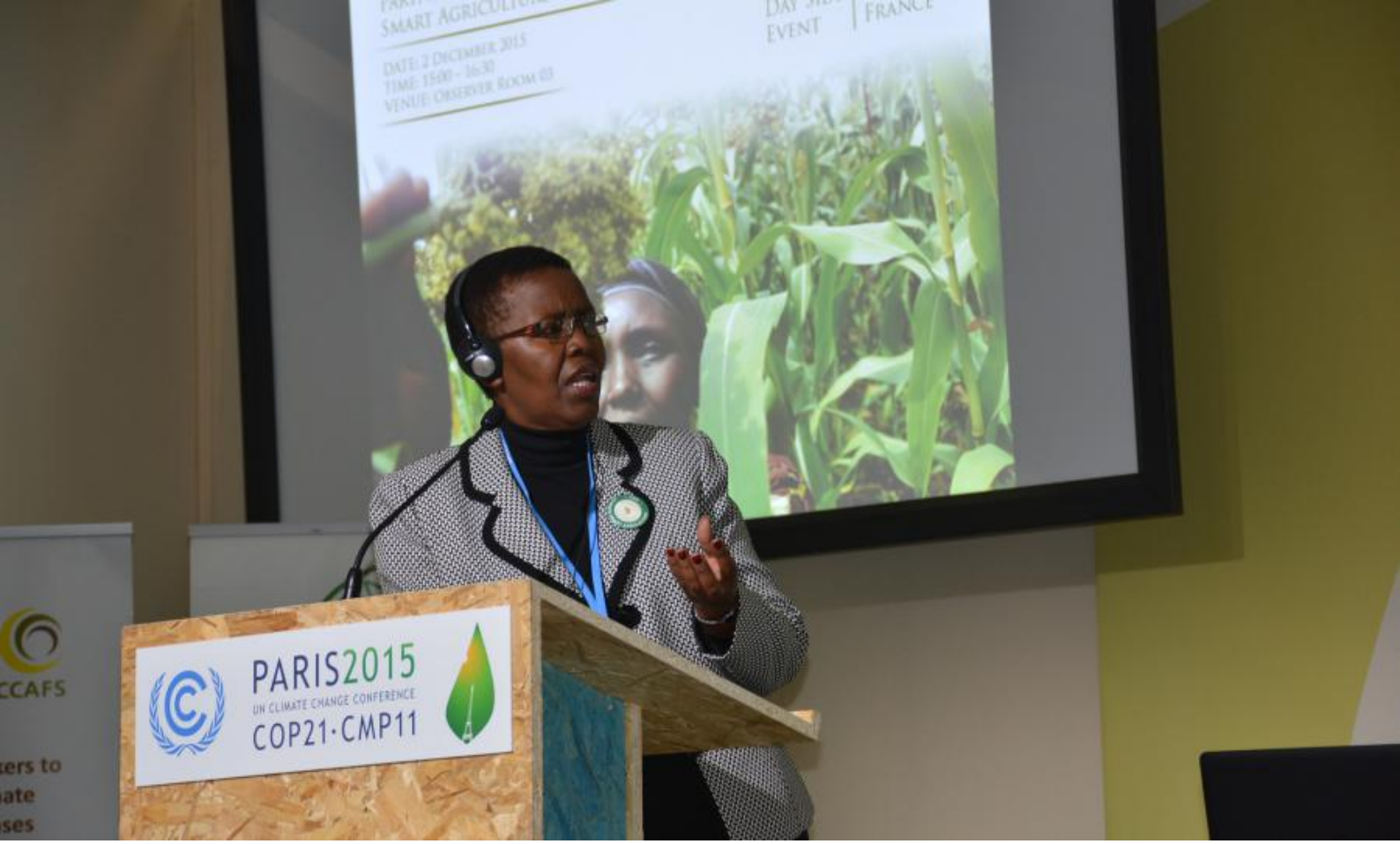

Photo: V. Atakos (CCAFS)

IMPACTS THROUGH POLICIES AND PARTNERSHIPS

Agriculture is integrated into Paris UNFCCC agreement

The very significant role of agriculture in climate change has been underrepresented in previous years' discussions and agreements in the UNFCCC process. Aided by several years of engagement by CCAFS and partners in the global agriculture community, including aa large push prior to the December 2015 climate conference, issues directly related to agriculture, such as food production and security are explicitly mentioned in the Paris Agreement concluded by the UNFCCC at its 21st Conference of Parties (COP21) in 2015.

Colombia Climate Smart Agricultural Sector - COP21 from Decision and Policy Analysis Program

Agriculture-related issues in the Paris Agreement

- Food security and the agreement
- Food, farming and climate change
- Agriculture's prominence in the INDCs
- 80% of INDCs committed to action on agricultural mitigation
- 90% of INDCs that include adaptation selected agriculture as a priority sector for action

Food security is prominent in the Paris Agreement. The preamble makes specific reference to safeguarding food security and ending hunger, and one Article details the importance of protecting food production when reducing greenhouse gas emissions. Human rights, gender, ecosystems and biodiversity, all issues central to agriculture, are also featured

> The Paris Agreement recognizes: "the fundamental priority of safeguarding food security and ending hunger, and the particular vulnerabilities of food production systems to the adverse impacts of climate change."

To ensure that a new climate change deal would not close the door on agriculture, CCAFS scientists provided several analyses on agriculture in the climate change negotiations, informing users about critical issues. They continued this engagement through more than a dozen events during the Paris meetings. The work was led by the CCAFS Coordinating Unit, hosted by the University of Copenhagen (UCPH), in collaboration with researchers and partners from across the programme.

CCAFS researchers also prepared material that informed the inputs of various parties into UNFCCC processes. Parties and observers to the UNFCCC used CCAFS briefs to understand how agriculture should be addressed in the agreement. CCAFS authors also produced submissions and interventions on agriculture for the Subsidiary Body for Scientific and Technological Advice (SBSTA). In 2015–2016, the African Group of Negotiators worked closely with CCAFS scientists to prepare its own submissions. Kenya and Costa Rica, among others, benefitted from advice in developing intended nationally determined contributions (INDCs).

Staff and collaborators worked with policy and research partners to provide information on the role of agriculture and food security through the UNFCCC Structured Expert Dialogue. Four submissions were made to the UNFCCC SBSTA Call on Agriculture in 2015, and a Toolkit to the UNFCCC Negotiations on Agriculture, produced with Farming First and the Technical Centre for

Agricultural and Rural Cooperation (CTA) was widely shared with agriculture advocates, to help them engage effectively at COP21. The toolkit also included a new section on gender and social inclusion in the context of agricultural development.

Aided by such input from CCAFS and its partners, the result was that food security was given prominence in the agreement: 80% of parties to the UNFCCC have included agriculture in their mitigation targets and 90% of those that include adaptation measures also list agriculture as a priority. A CCAFS analysis of the COP21 outcomes was widely read and shared by the global agriculture community and in the media. CCAFS briefs were downloaded more than 6 000 times in the 4 weeks surrounding COP21 and continue to be a source of information as agriculture remains on the agenda in the 2016–2017 SBSTA process.

Read more

- UNFCCC Toolkit: Update on Agriculture in the UNFCCC
- CCAFS Blog: Paris Climate Agreement unlocks opportunities for food and farming
- Hedger et al. 2015. Progress on agriculture in the UN climate talks: how COP21 can ensure a food-secure future. CCAFS Info Note

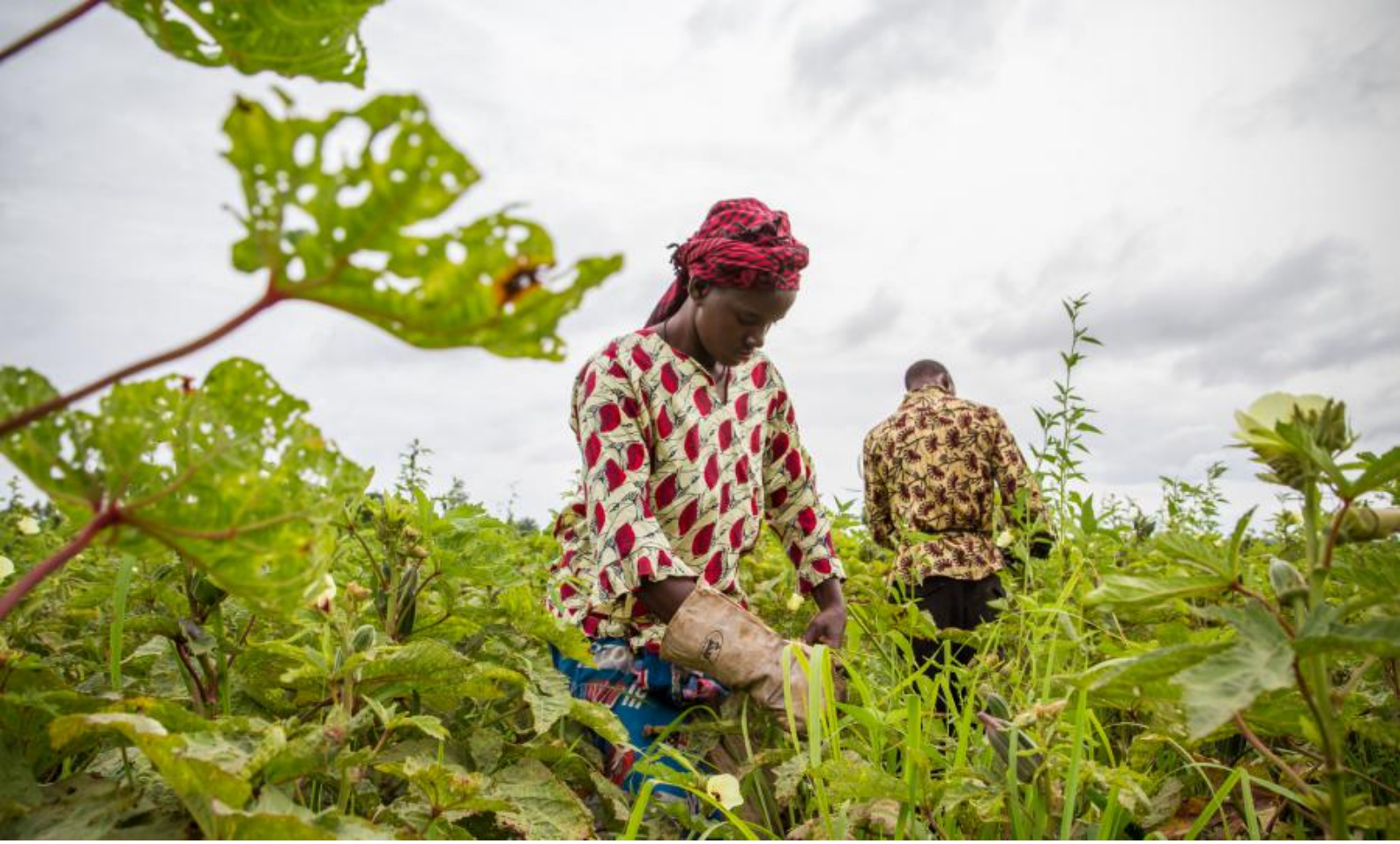

Photo: F. Fiondella

IMPACTS THROUGH POLICIES AND PARTNERSHIPS

A new climate-smart agriculture alliance for West Africa

Many West African governments were interested in with climate-smart agriculture but were unsure about the best way to develop policies that would assist the agricultural community to confront climate change. In 2015, the Economic Community of West African States (ECOWAS), which comprises 15 countries, used CCAFS-generated knowledge to guide the framing of a West Africa climate-smart alliance.

In the lead up to a high-level forum to develop climate-smart agriculture (CSA) in West Africa, ECOWAS tasked CCAFS to develop a framework document to

inform its discussions. Staff in the CCAFS West Africa office were active participants in the forum's technical team. This involvement led to the preparation of background material on climate-smart agriculture and its implications for agriculture in the West Africa region. ECOWAS aims to integrate public policy instruments into its Regional Agricultural Investment Program to adapt West African agriculture to climate change through climate-smart agriculture.

The forum took place in Bamako, Mali, on 15–18 June 2015. The CCAFS contribution guided ECOWAS and other West African stakeholders in designing a suitable CSA alliance and an implementation framework that fits well with the West Africa Regional Agricultural Policy (ECOWAP).

One of the major outputs of the collaboration was an analysis of the existing knowledge on the state of climate-smart agriculture in West Africa, as well as its future. The paper, 'Overview of the Scientific, Political and Financial Landscape of Climate-Smart Agriculture in West Africa', covers the sub-sectors of crop production, livestock, fisheries, water and forestry/agroforestry. It was written in collaboration with a number of CGIAR Centers (IWMI, IFPRI, ILRI, ICRAF and ICRISAT), the West and Central African Council for Agricultural Research and Development (CORAF) and the University of Ibadan, Nigeria.

> "We speak more and more about intelligent economics, intelligent governance, and now we are speaking about intelligent agriculture"
> **Modibo Keita, Prime Minister of Mali**

At the forum, contributing scientists gave keynote addresses to assist in the discussions. The ultimate aim was to see equitable national food system policies enacted that take into consideration climate-smart practices and strategies.

As a way of contributing to this process, the ECOWAP/CAADP Intervention Framework for the Development of CSA was officially adopted and launched. The Framework supports the essential inter-sectoral approach among the agriculture, environment and climate change, and water and energy sectors to establish climate-smart agriculture. ECOWAS and its member countries are now effectively mainstreaming CSA into regional and national agricultural plans and policies. The West Africa CSA Alliance will support the implementation of the Framework, allowing progress to be made towards improving the lives of millions of farming households in West Africa.

Read more

- ECOWAS Concept Note. 2015. High Level Forum of Climate-Smart Agriculture Stakeholders in West Africa
- Zougmoré R et al. (eds) 2015. Overview of the Scientific, Political and

Financial Landscape of Climate-Smart Agriculture in West Africa. CCAFS Working Paper No. 118

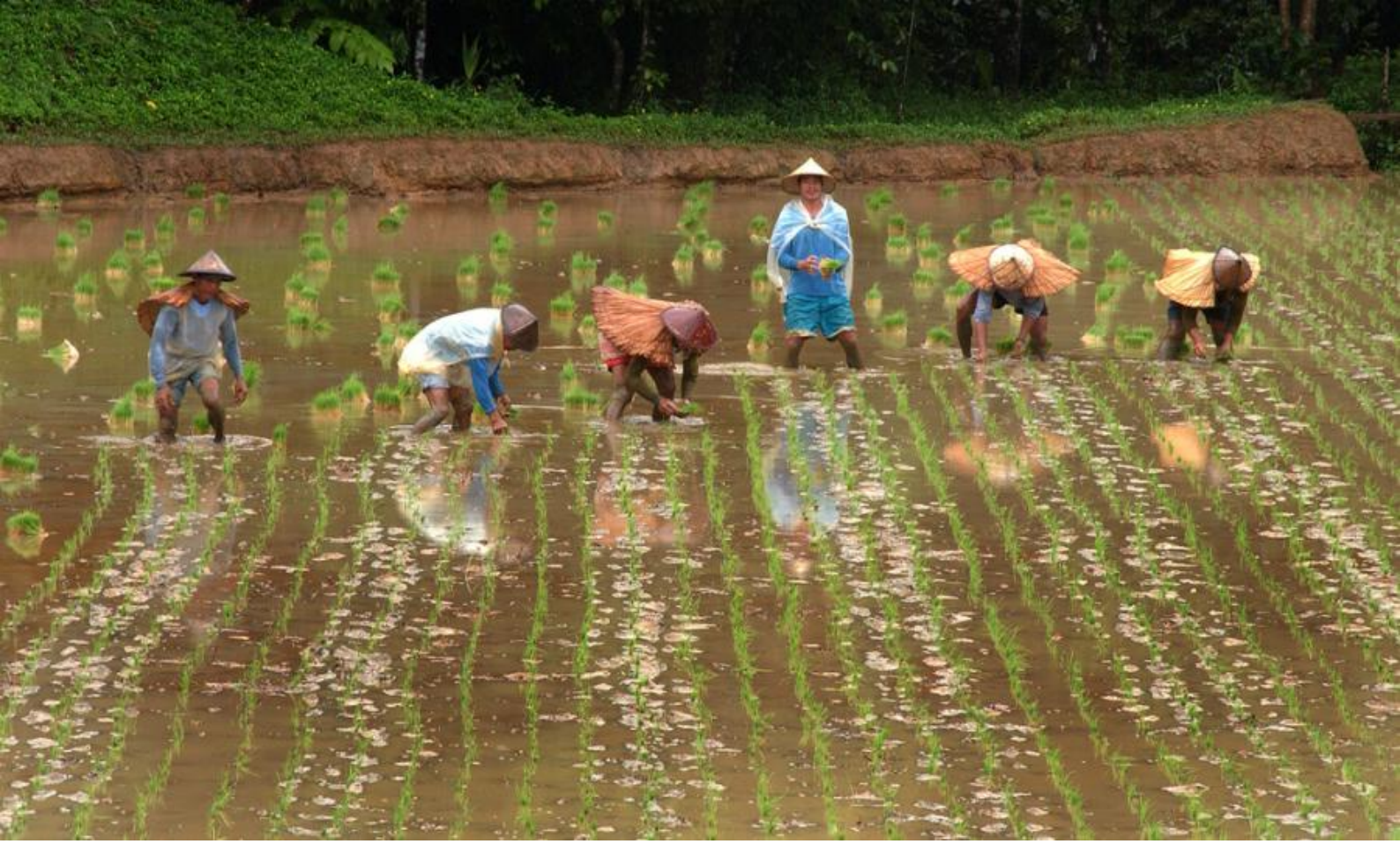

Photo: IRRI

IMPACTS THROUGH POLICIES AND PARTNERSHIPS

Scaling up water saving technology to benefit rice farmers in Bangladesh and Vietnam

Traditional rice production techniques are water and labour intensive, and using diesel pumps to supply well water can be expensive for farmers. Continuously flooded rice paddies also generate methane, a harmful greenhouse gas. To tackle this problem, Bangladesh and Vietnam worked with CCAFS experts to scale up the use of an innovative water-saving technology called 'alternate-wetting-and-

drying' (AWD) in rice, which has produced the major side benefit of reducing greenhouse gas emissions.

With AWD, farmers periodically drain their rice paddies, while making sure that the soil does not dry out, rather than keeping them continuously flooded. This approach reduces the amount of water they need by up to 30%, which can be a blessing in times of drought. If they are pumping water for irrigation it also lessens their fuel costs. In addition, the technique cuts down methane emissions, because the gas is generated under anaerobic soil conditions when water is standing in the fields. AWD can reduce methane emissions by up to 48% without reducing rice yields.

Two consortia involving the Ministries of Agriculture for Bangladesh and Vietnam worked with CCAFS to produce national workplans for scaling up AWD in rice. As part of a project on low-emissions agriculture, CCAFS scientists from the International Rice Research Institute (IRRI) worked with partners in each country. They identified ways to engage policymakers, build alliances to train farmers in the technique and work out how technical guidance will be channelled.

The IRRI scientists developed maps for the 2 countries that showed where and when AWD would be most suitable. Countries will use this information to plan how to scale out the technique to farmers. Stakeholders, brought together in workshops, considered the different people involved in the adoption process and developed engagement and communication strategies. Areas were then identified where AWD will have the most impact.

> "Various altered crop management strategies have been suggested ... but AWD is still the most promising option." **Dr Reiner Wassmann, Senior Scientist at IRRI**

As a result of the work, Bangladesh has been awarded USD 214 million by the World Bank to implement a programme of agricultural technology involving 1 million farmers. Vietnam is working with international development programmes to reach more than 1 million rice farmers, especially in its delta regions, which account for most of Vietnam's total annual greenhouse gas emissions.

The broader impact of the technology will be to reduce methane emissions from rice production, while increasing food security and the adaptive capacity of farmers across the rice-producing areas of the world.

Read more

- CCAFS Blog: Alternate wetting and drying in irrigated rice
- CCAFS Blog: New climate and clean air coalition agriculture effort tackles climate change, supports rice production

- IRRI Blog: Bangladesh plans for 'alternate wetting and drying' outscaling

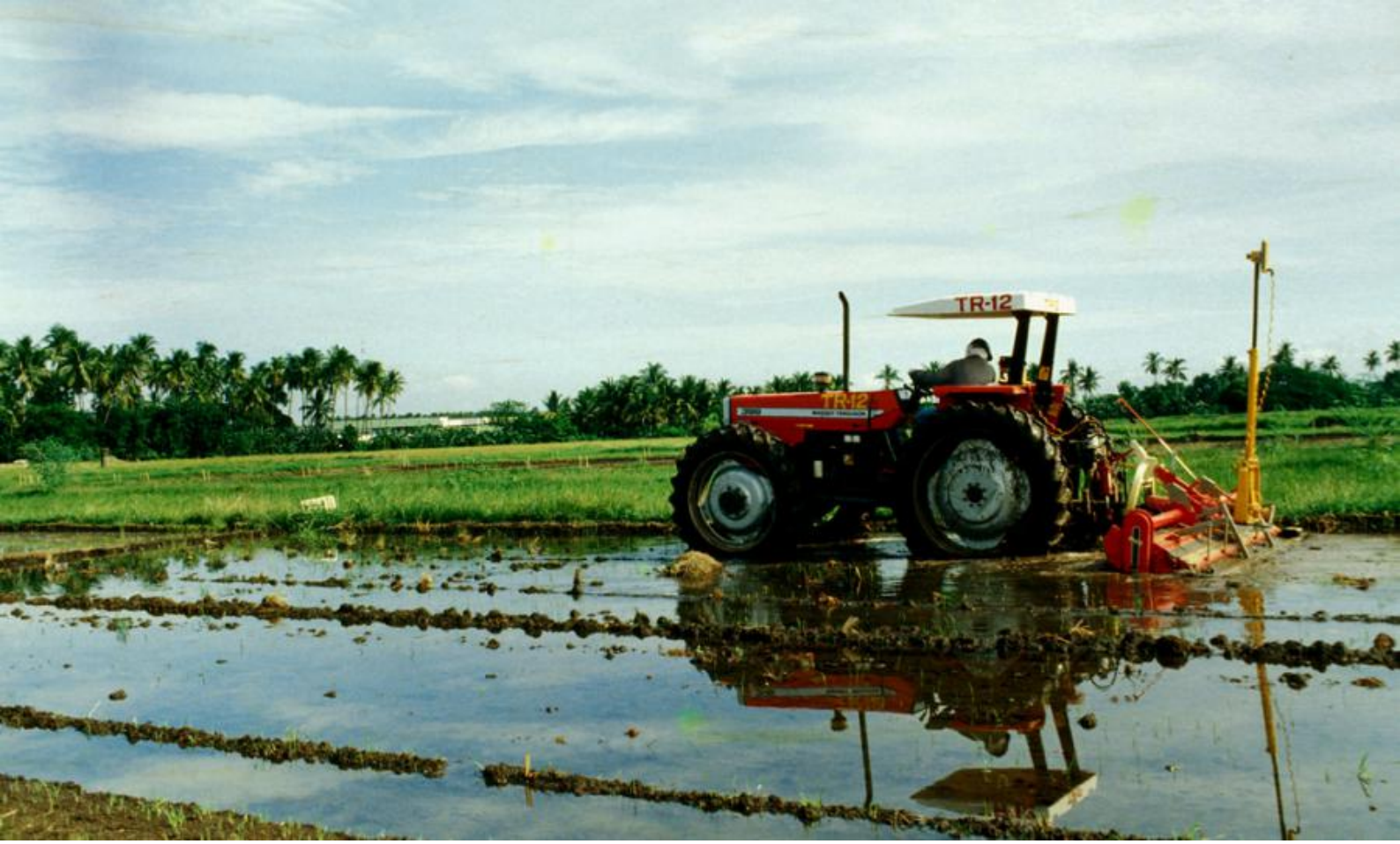

Photo: IRRI photos

IMPACTS THROUGH POLICIES AND PARTNERSHIPS

Scaling up private sector engagement in climate-smart agriculture

The food we eat, much of it supplied through global agribusiness companies, has a big impact on the climate. At the same time, the food system is highly vulnerable to climate change. To address this, the world's biggest agribusinesses, with collective revenues of over USD 800 billion, announced ambitious plans to tackle emissions and increase food supplies at the December 2015 Paris climate conference. In 2015, CCAFS contributed to this process.

The companies, associated with the World Business Council for Sustainable Development (WBCSD), launched the Action Plan for climate-smart agriculture

(CSA), which aims to reduce greenhouse gas emissions from agriculture and land use by half and increase the production of nutritious food by 50%. To successfully adapt to climate change, activities will be targeted at increasing the overall climate resilience of agricultural and farming communities worldwide. A further aim is to reduce annual agricultural greenhouse gas emissions by at least 30% compared to 2010 levels.

The WBCSD is a CEO-led membership group of 200 global companies that aims to promote sustainable business practices, especially under its new Low Carbon Technology Partnerships initiative (LCTPi). The CSA Working Group is made up of PepsiCo, Monsanto, Olam, Kellogg Company, Starbucks, Diageo, Coca-Cola, Yara International, Tyson Foods, Walmart, Du Pont, Banamex, Unilever, PwC and Novozymes.

WBCSD approached CCAFS to partner with them to provide scientific advice, develop the action plan, and eventually monitor progress. The private sector is becoming increasingly aware of the need to develop climate-smart business practices, not only because agriculture and food supply chains are responsible for upwards of a quarter of global emissions, but also because climate change will have a major impact on food production – affecting these companies' bottom lines – unless farming becomes more resilient.

To see first-hand how climate-smart agriculture can benefit farmers while helping them to adapt to climate change and reduce emissions, a group of agribusiness executives visited CCAFS Climate-Smart Villages in Haryana, India. There, they met farmers working with scientists to test and apply agricultural interventions that could help them to grow more food with less water and fertilizer and to plan for unpredictable weather. These tools and approaches, including laser land levelling, climate information services and NutrientExpert, make good business sense not only to the farmers, but also to large agricultural companies that depend on stable crop yields to maintain their supply chains.

> "It was inspiring to see how farmers, business and research organisations can work together to build a locally relevant farming approach with reduced inputs, improved yields and most importantly increased resilience." **Jenny Bell, Europe Sustainability Risk and Impact Manager, PepsiCo**

Working under the strategic and scientific guidance of the CCAFS programme, the Working Group identified priority actions that will set and meet meaningful targets to support smallholder farmers and bring prosperity through long-term relationships based on fairness, trust, women's empowerment and the transfer of skills and knowledge.

The action plan is a work in progress, with 4 priority areas. Initially, work will focus on building up the resilience of smallholder farms, which make up the

majority of farms in the developing world. At the same time, efforts will be made to scale up private sector investment in CSA, and improve businesses, ability to track, measure and monitor its progress. A final thread will be to work towards sustainable land-use commitments.

To develop sustainable long-term solutions, the Working Group is drawing on the expertise of the global agricultural community through regional dialogues with farming, non-governmental, research and agribusiness organizations around the world. The WBCSD has invited CCAFS to continue to working closely with them as the plan unfolds.

Read more

- CCAFS Blog: Scaling up climate-smart agriculture through private sector engagement
- WBCSD Blog: Agri-business leaders get climate smart at COP21 and aim to make 50% more food available and reduce agricultural emissions by 50% by 2030
- Business Fights Poverty Blog: How science can inform business climate commitments

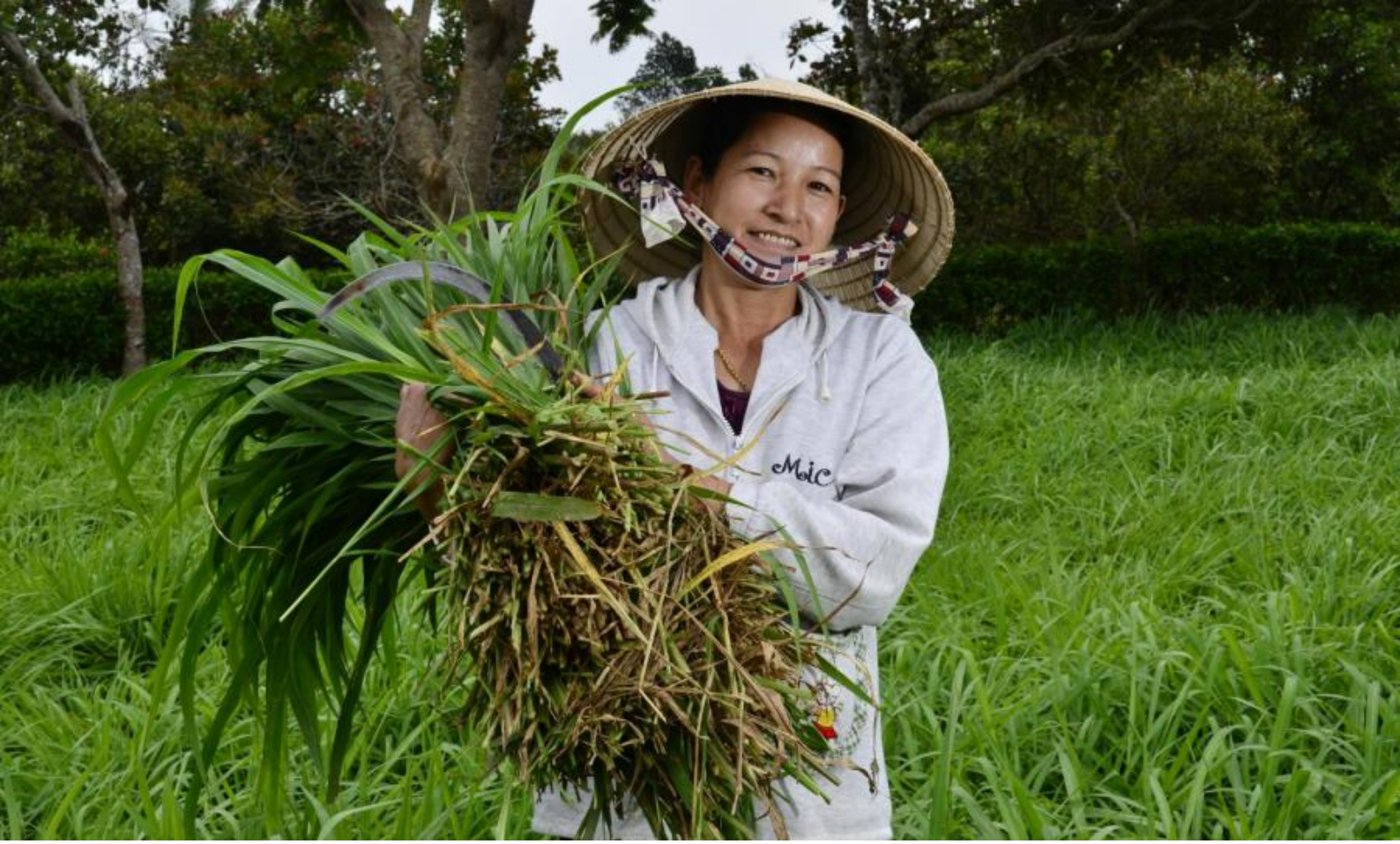

Photo: N. Palmer (CIAT)

IMPACTS THROUGH POLICIES AND PARTNERSHIPS

Institutionalising the development of low emissions agriculture

The CCAFS flagship programme on low emissions agriculture identifies agricultural development options that reduce greenhouse gas emissions and increase carbon sequestration, without undermining food security. Over the past 3 years, the programme has conducted and published research to help countries identify low emissions agricultural strategies and priorities for mitigation, with the objective of assisting policymakers in prioritizing their low emissions development (LED).

In 2015, CCAFS continued to work to improve estimates of emissions on

smallholder farms, and supported the widespread implementation of low emissions agricultural practices and policies. Projects with a variety of partners such as the Food and Agriculture Organization of the United Nations (FAO) and the International Fund for Agricultural Development (IFAD) examined the level of mitigation effort required from either developing countries or smallholder farms to stay within desired climate change thresholds. Other research looked at what effect the adoption of bioenergy would have on food prices and land-use change.

These analyses and communications have been informing the World Bank and IFAD about good opportunities in LED. As part of its own work on climate change in the developing world, the World Bank commissioned a background paper: 'Climate change impacts and mitigation in the developing world'.

CCAFS research on scenarios for achievable LED solutions, in collaboration with the International Institute for Applied Systems Analysis (IIASA), provided a basis for the Bank's assessment of the impact of mitigation policies on food prices and food security.

> "Smart investments in smallholder adaptation can deliver mitigation co-benefits [...] of up to 30 million tons of CO2e via emission reductions and carbon sequestration resulting from project implementation" Mitigation advantage report **(IFAD 2015)**

IFAD also found the CCAFS analysis useful in identifying significant opportunities for increasing the mitigation benefits of its Adaptation for Smallholder Agriculture Programme (ASAP). IFAD published a report in 2015 citing the CCAFS-FAO project report stating that "*the study has enabled IFAD to realize that investing in a few effective upgrading options could allow its projects to more than double initial mitigation benefits.*"

Read more

- CCAFS Research area: Identifying low emissions development pathways
- CCAFS Research area: Climate-smart agricultural practices
- IFAD. 2015. The mitigation advantage–maximizing the co-benefits of investing in smallholder adaptation initiatives
- Havlík P et al. 2015. Climate change impacts and mitigation in the developing world. World Bank Policy Research Working Paper

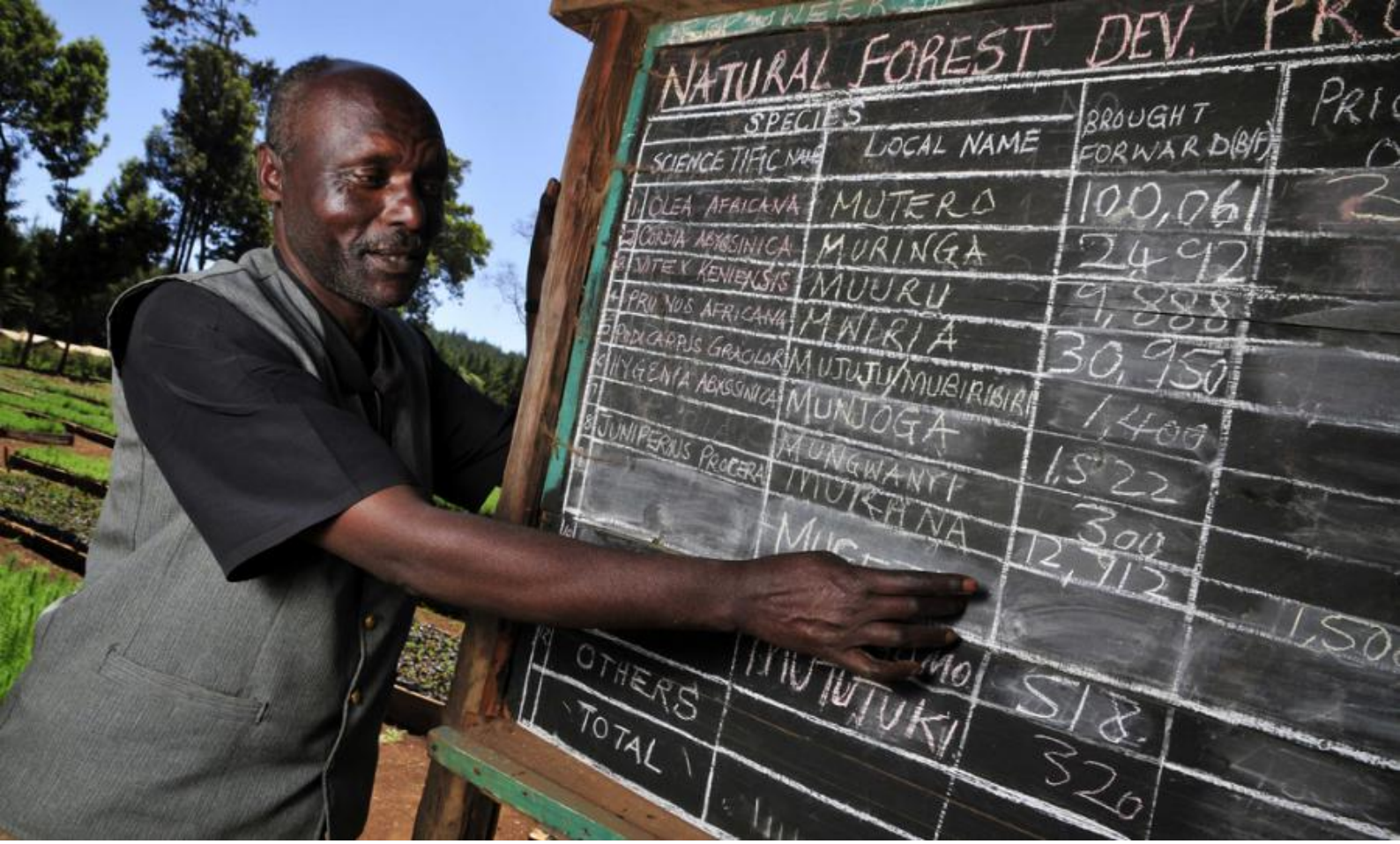

Photo: N. Palmer (CIAT)

IMPACTS THROUGH POLICIES AND PARTNERSHIPS

African partnerships set sights on scaling up climate-smart agriculture

In Africa, policymakers and investors have taken a growing interest in developing climate-smart agriculture (CSA). To support this, CCAFS has been providing scientific analyses to policymakers and have taken an active role in helping to engage stakeholders.

Strategic support for the development of a Climate-Smart Agriculture Sector in Niger from Decision and Policy Analysis Program

Large-scale investment is needed to scale out climate-smart agriculture if it is to create transformational change within agricultural systems. The project Partnerships for Scaling (P4S), co-led by the World Agroforestry Centre (ICRAF) and the International Center for Tropical Agriculture (CIAT), is changing how people approach climate-smart agriculture in Africa. The P4S approach uses accurate information to develop models and tools that allow partners to decide on how to move towards climate-smart agriculture.

Scientists at the International Livestock Research Institute (ILRI) have already used P4S to produce climate scenarios and the potential impacts of climate-smart agriculture in Botswana, Kenya, Namibia, Tanzania and Uganda. The data, especially the climate modelling developed by CCAFS research, assisted the Common Market for Eastern and Southern Africa (COMESA) to develop CSA Framework Programs for the 5 countries.

The New Partnership for African Development (NEPAD), which is the technical arm of the African Union, has used P4S research to help shape a practical guide they are developing. The guide will be a vital cornerstone of NEPAD's Vision 25x25 initiative, which is focused on introducing 25 million African farmers to CSA by 2025. It came out of the African Union Leaders' 'Malabo Declaration' of 2014, which set a path forward for African agricultural development over the next decade.

Scientific and technical support is needed to help NEPAD and its partners achieve the Malabo goals, and CCAFS is closely involved in providing this assistance.

Read more

- CCAFS Tools: Climate-smart agriculture plan: a guide to scaling CSA
- NEPAD website: Natural resources governance and food security
- CCAFS Blog: Building momentum for climate-smart agriculture in West Africa
- CCAFS Publication: Partnerships for scaling Climate Smart Agriculture (P4S-CSA): Linking experiences between LAM, Africa, & Asia

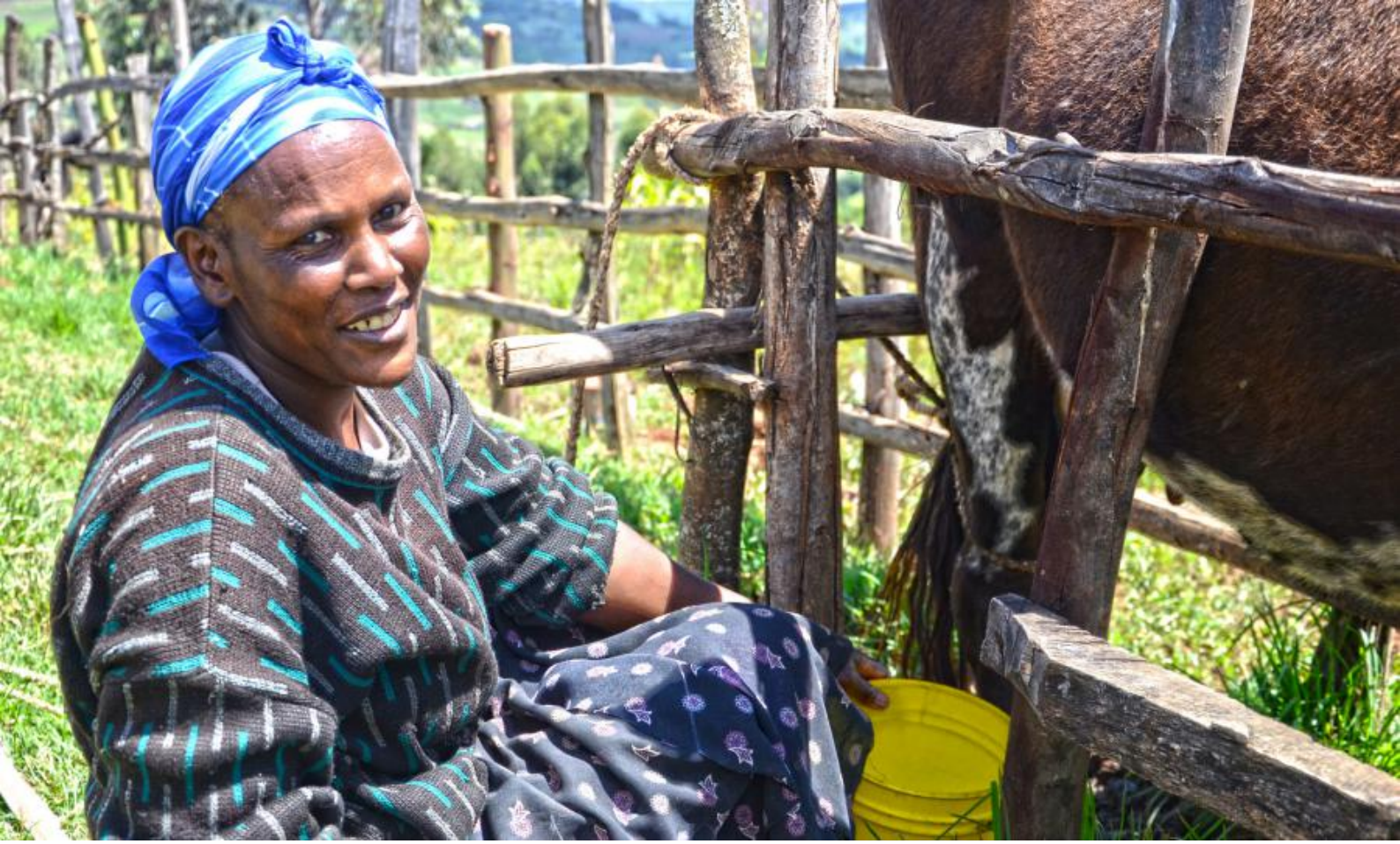

Photo: S. Odeyo (ICRAF)

CAPACITY DEVELOPMENT AND INNOVATIVE COMMUNICATION

Pulling together to develop capacity for climate-smart dairy farming in Kenya

Demand for dairy products in Kenya will rise. However, more dairy farming will mean more emissions of greenhouse gases, especially methane, unless farmers adopt climate-smart farming practices. Scientists, government authorities, the private sector, producer organizations and development agencies are pulling together to develop the capacity of the dairy industry in climate-smart practices to reduce emissions.

Climate-smart practices to reduce greenhouse gas emissions from dairy farming

- Incorporate fodder shrubs and herbaceous legumes in cropping systems to sequester carbon
- Zero-graze to manage manure
- Use manure as a fertilizer
- Install biogas units to process manure

CCAFS scientists from the World Agroforestry Centre (ICRAF) and the International Livestock Research Institute (ILRI) are helping to scale out climate-smart practices suitable for dairy farming in Kenya. Using information gathered and analysed about how farmers elsewhere in the world cope with challenges to production, scientists worked with farmers to select the climate-smart practices that would work best in Kenyan dairy farming conditions. Information on successful practices that farmers already use is the key to mainstreaming climate-smart agriculture.

Throughout 2015, CCAFS scientists and UNIQUE Forestry and Land Use Ltd consultants met with ministries, donors, dairy companies and producer organizations – especially those that have the capacity for outreach. They also met frequently with officials in the State Department of Livestock and the Ministry of Agriculture Livestock and Fisheries. In addition, they partnered with the Mt Elgon smallholder dairy development and watershed protection project, funded by the Livelihoods Fund (Danone) and Brookside Dairy.

These climate-smart feeding and husbandry practices were disseminated among members of 6 producers' organizations comprising 600 000 farmers, 25% of whom are women. The team also targeted organizations and companies that might offer technical and financial support. A Kenyan company, Brookside Dairy and the Livelihoods Fund for Family Farming (Livelihoods 3F), an investment fund launched in 2015, are progressing a USD 3.5 million project. The project will help 30 000 Kenyan farmers to put climate-smart dairy farming methods into practice.

> "Potential improvements to the livestock sector are wide and include increased market access, decreased fragmentation of value chains, improved private sector participation and stable milk supplies. In turn, this increases incomes and improves nutrition for rural people engaged in livestock-based livelihoods." **Timm Tennigkeit, Unique Forestry and Land Use Ltd**

The potential for the dairy industry to raise productivity and at the same time reduce livestock emissions by 18–30% is significant. CCAFS work to develop capacity in climate-smart dairying across the sector helps scale out practices that reduce emissions, boost livelihoods and build resilience.

Read more

- van Dijk S et al. 2015. Climate-smart livestock sector development: the state of play in NAMA development. CCAFS Working Paper No. 105
- World Bank, CIAT. 2015. Climate-smart agriculture in Kenya. CSA Country Profiles for Africa, Asia, and Latin America and the Caribbean Series

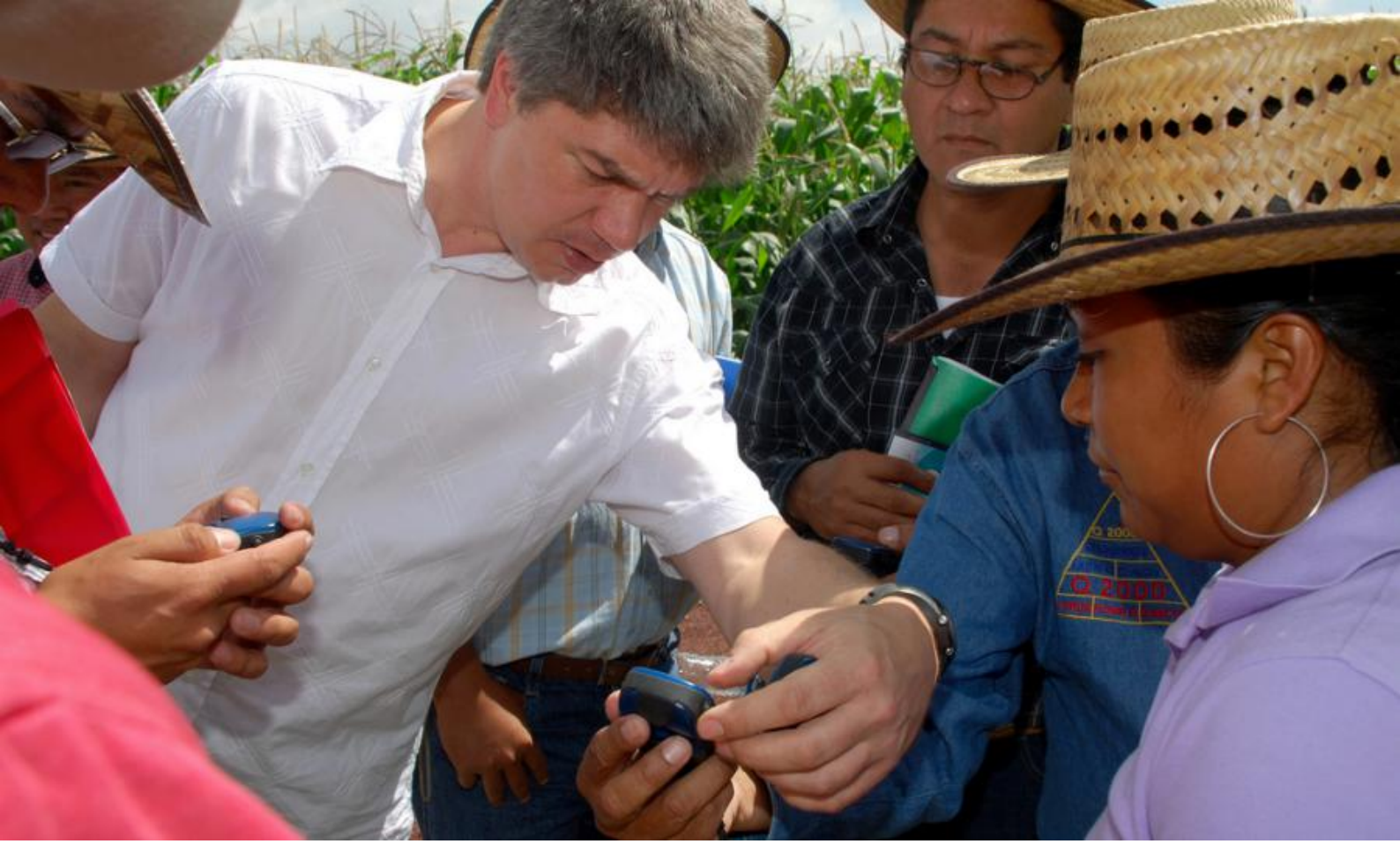

Photo: X. Fonseca (CIMMYT)

CAPACITY DEVELOPMENT AND INNOVATIVE COMMUNICATION

Mapping software helps decision makers analyse adaptation options

The ability to use mapping tools to assess opportunities for adapting to climate change in particular areas is important for selecting, prioritizing and implementing best-bet climate-smart agriculture options. Worldwide, the tools developed by CCAFS for analysing alternatives are helping decision makers take action.

CCAFS scientists at Bioversity International, partnering with national agricultural research systems, ministries of agriculture and regional organizations, have boosted the capacity of professionals across the world (see

box below) to map agro-ecological regions, farming systems and environments, and to analyse the likely effects of climate change

CCAFS has developed open-source software, using languages such as R, to generate climate maps and crop suitability models, that allow users to combine biophysical, social and economic data to analyse options for adapting to climate change. Software packages, for example, let users map the distribution of a species, downscale global circulation models, analyse rainfall variability in South Asia or locate climate-adapted germplasm. The Bioversity seeds resource box website provides advice on which software to use for a specific purpose

The software packages are now used by a wide range of people, from plant breeders, researchers, gene bank managers, extension agents and policy makers to university lecturers, graduate students and professionals in government, non-government organizations and the private sector.

Read more

- Vernooy R et al. 2015. A novel strategy to discover and use climate-adapted germplasm. Bioversity International
- Bioversity International website: Resource box for resilient seed systems

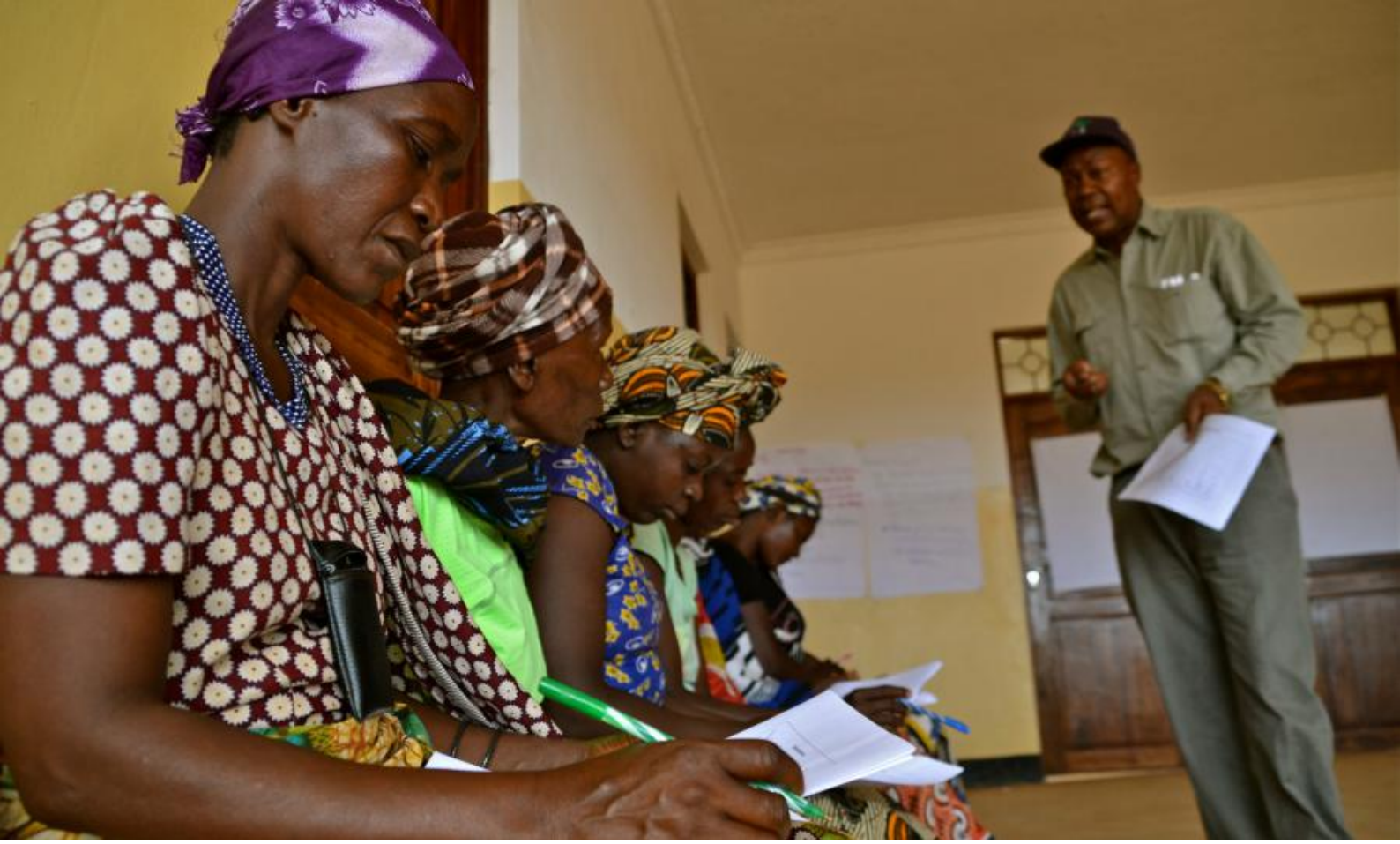

Photo: C. Schubert (CCAFS)

CAPACITY DEVELOPMENT AND INNOVATIVE COMMUNICATION

Locally tailored climate information helps African smallholders tackle climate change

Climate change calls for an innovative approach to rapidly enhance the capacity of smallholders to deal with erratic rainfall and increasing temperatures. It also brings unprecedented, rapid changes that may exceed farmers' natural ability to adapt. A novel approach, called Participatory Integrated Climate Services for Agriculture (PICSA), makes available historical records and forecasts from

meteorological agencies, providing farmers with information matched to their locality in a form that they can easily understand and use. Participatory tools allow farmers to combine accurate, location-specific, climate and weather information with locally relevant crop, livestock and livelihood options.

In 2015, CCAFS began scaling out the approach in West and East Africa. Scientists at the World Agroforestry Centre (ICRAF) tailored PICSA to northern Ghana. The CCAFS research team at the University of Reading, where PICSA was first developed, launched a manual explaining PICSA, a field guide and a guide for trainers. ICRAF and the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) organized courses for staff in the Ghana Meteorological Agency. Meteorologists learned how to analyse historical weather data for input to PICSA and how to prepare smallholder-friendly seasonal forecasts and weather advisories

> "... seasonal forecast outputs (covering a large zone) would be of little use for a farmer making decisions at a specific location. The training was thus on the basics of downscaling ..." **Dr Ousmane Ndiaye, Senegal Meteorological Service**

The African Institute for Mathematical Sciences (AIMS) trained extension workers and staff in non-governmental organizations to use the PICSA approach. Trainers explained how historical climate data, together with seasonal and short-term forecasts, can help farmers plan which crops to plant and when. Once trained, local staff worked with groups of farmers well ahead of the planting season. As the time for planting approached, extension staff and farmers looked at the seasonal and short-term forecasts and fine-tuned their tactics.

Information about crops best suited to prevailing weather and climatic conditions, along with accurate forecasts, can lower the potential risk of farming. Farmers become more resilient. In 2015, by deploying the PICSA approach, CCAFS helped over 6 000 farmers in 140 communities in northern Ghana make their own decisions to adjust their crop, livestock and other livelihood practices to better match seasonal forecasts.

AIMS training of trainers for Oxfam and the Adventist Development and Relief Agency (ADRA) means that the PICSA approach will soon reach farmers in Burkina Faso and Mali. The approach is already being deployed in Malawi and Tanzania in East Africa too, through the Global Framework for Climate Services (GFCS) project and to Lesotho through the International Fund for Agricultural Development (IFAD). Other organizations adopting or adapting the PICSA approach are Farm Africa in Kenya, and Practical Action and World Vision in Zimbabwe.

Read more

- Dorward P et al. 2015. Participatory Integrated Climate Services for Agriculture (PICSA): Field Manual. Walker Institute, University of Reading
- CCAFS Blog: How 'training-of-trainers' reach farmers with participatory climate information services (CCAFS) September 2015

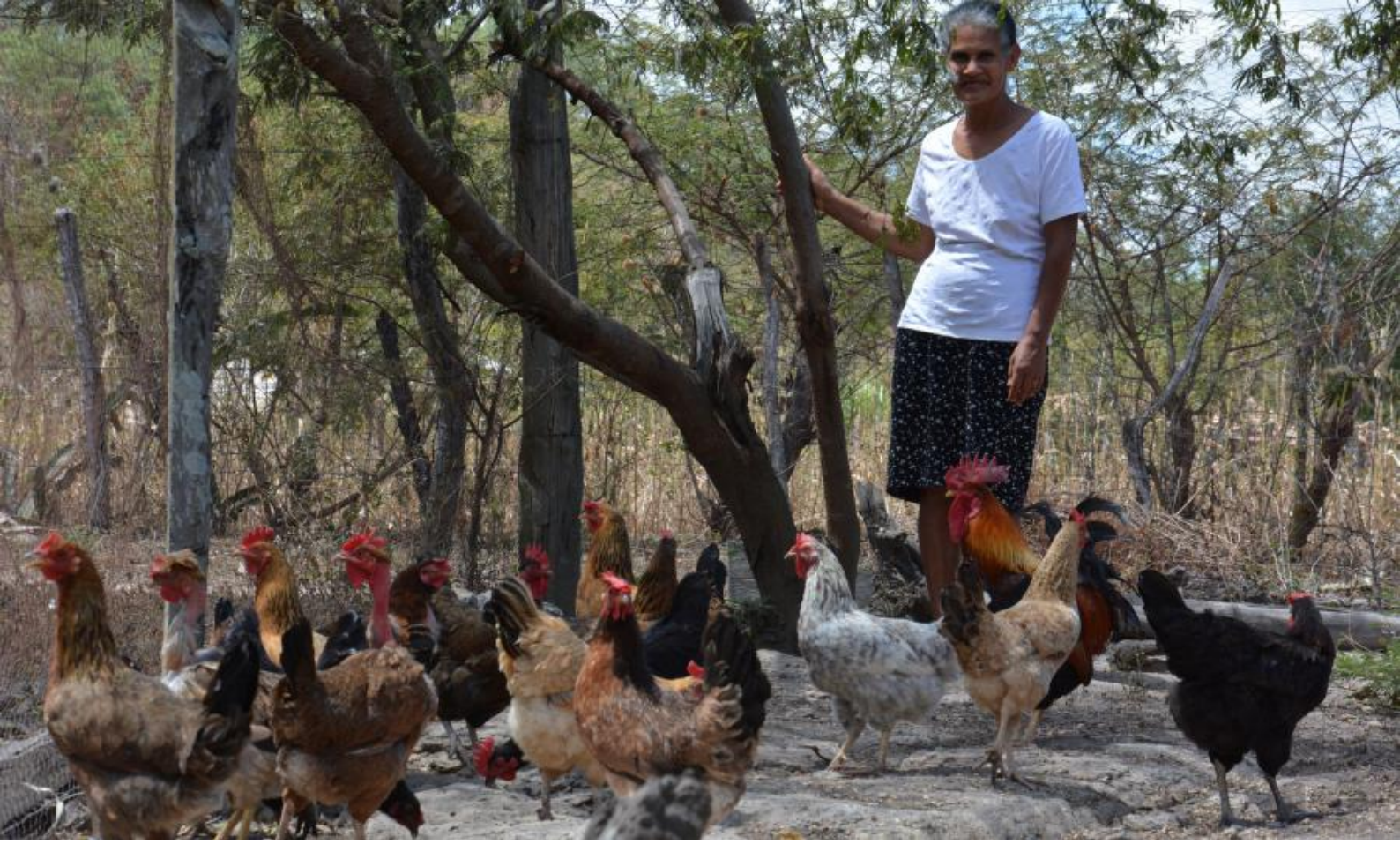

Photo: J. L. Urrea (CCAFS)

CAPACITY DEVELOPMENT AND INNOVATIVE COMMUNICATION

Local committees move Colombia towards climate-smart agriculture

Colombia is moving towards adopting agricultural practices that reduce risks and maximize productivity under climatic variability and change. To do this, evaluations of how different crop varieties perform under future climate scenarios, seasonal agro-climatic advisories and recommendations for management practices are needed to help farmers select the crops and practices best suited to their area.

CCAFS scientists at the International Center for Tropical Agriculture (CIAT) to provide vital scientific support for mitigating climate risks to the Colombian

agricultural sector. Agronet, a Colombian government website that reaches 500 000 farmers, now features information provided by CCAFS on climate-smart farming, and an Agroclimatic Bulletin published by CCAFS is helping to out-scale climate-smart practices.

A team of scientists from CIAT and the Colombian Corporation for Agricultural Research (CORPOICA) have developed Climate-Site Specific Management (CSMS), a tool to evaluate how different crop varieties are likely to perform in specific locations in variable climatic conditions and as the climate changes. Using the CSMS, scientists can determine, for any location, the factors that limit a crop, for example, the number of days and severity of frosts in a year, and local climate and weather data over the long and short term.

The scientists presented the findings and weather data to Mesa Técnica Agroclimática, local technical agroclimatic committees, which CCAFS had helped to set up. These committees include public institutions, producer associations, universities and the private sector. They aim to provide farmers with agroclimatic advice tailored to their needs.

Producer organizations passing on agroclimatic advice to their members include the Colombian National Federation of Rice Growers (FEDEARROZ) with 24 000 members; the National Federation of Cereal and Grain Legume Growers (FENALCE) with 7 000 members; the Colombian Association for Fruits and Vegetables (ASOHOFRUCOL) with 20 members; and the Foundation for Territorial Sustainable Agriculture (FUNDESOT) with 200 members.

Farmers and extension workers use the agroclimatic advice to select varieties best adapted to the farming zone. The seasonal forecasts help them to decide what to grow and where, and to estimate how much the most adapted varieties are likely to yield under forecast conditions. They can analyse information to determine the factors most likely to limit production on their farms – an invaluable skill that will serve them lifelong in adapting to climate change.

Government officials are using CCAFS training manuals to set up Mesa Técnica Agroclimática around the country. Setting up 15 Mesa Técnica Agroclimática by 2030 is central to the Colombian Intended Nationally Determined Contribution (INDC) in order to deliver its commitments under the Paris Climate Agreement.

Read more

- CCAFS Blog: Colombia committed to climate-smart agriculture
- CCAFS Research: Climate-Smart Agricultural Practices
- Mesas Técnicas Agroclimáticas
- Boletín Agroclimático Local

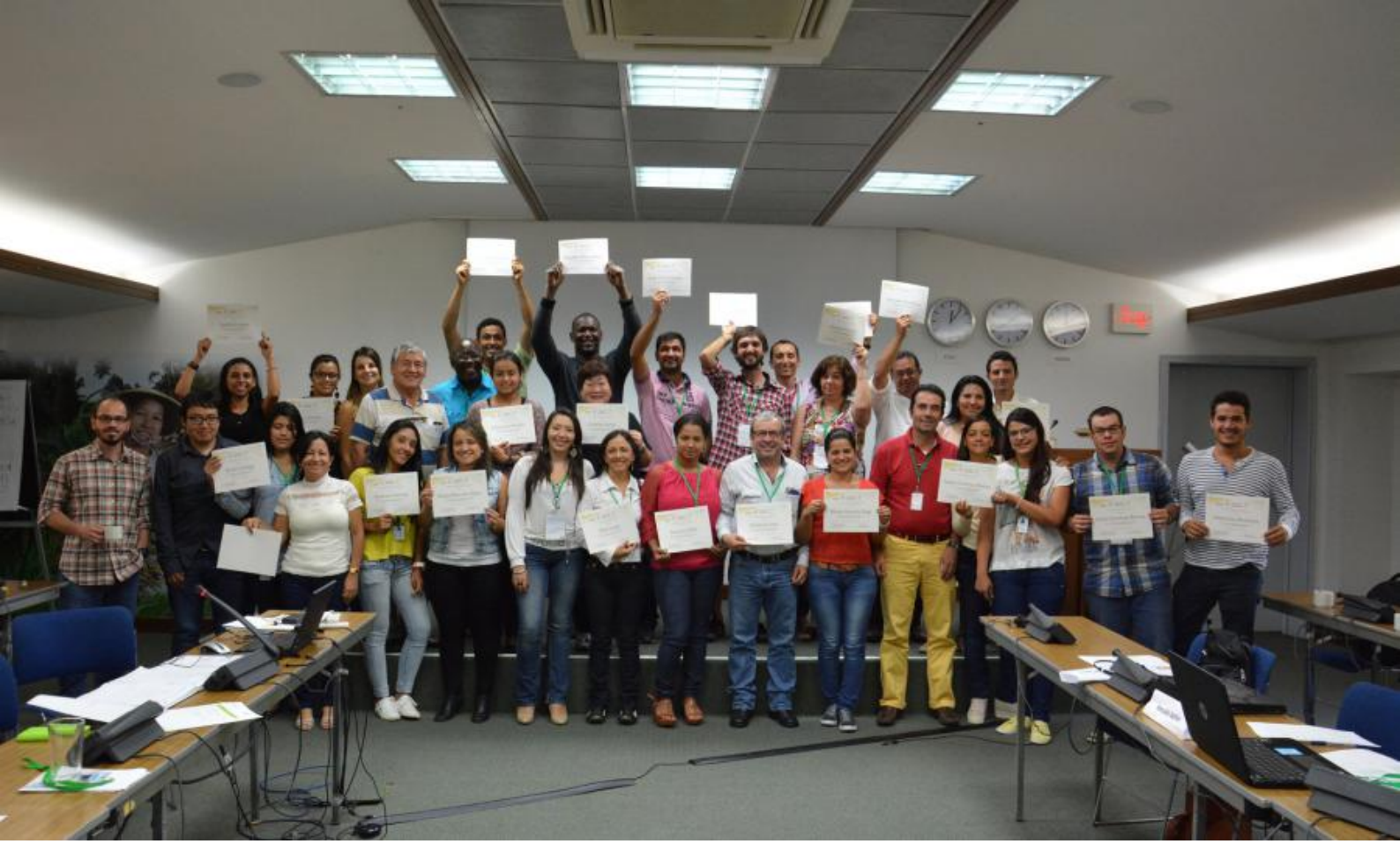

Photo: J. L. Urrea (CCAFS)

CAPACITY DEVELOPMENT AND INNOVATIVE COMMUNICATION

Summer school spearheads network to tackle climate change

Mitigating climate change on small scale farms requires a coordinated approach using the best available technologies. Developing such an approach was the rationale behind a summer school, held by CCAFS and Latin American partner organizations in August 2015, to promote climate change mitigation in smallholder crop and livestock systems in the region.

The summer school was a leading event of the Latin America Greenhouse Gas Mitigation Network (LAMNET) – a wider network promoting innovation in climate change mitigation in Latin America. Forty-nine people attended the

course, including PhD students and representatives of farmer associations, non-government organizations, research institutions and government ministries. Hosted at the headquarters of the International Center for Tropical Agriculture (CIAT) in Cali, Colombia, the course looked at new ways of measuring greenhouse gases released from agriculture and strategies for reducing these emissions.

> "We not only talked about science, we had a very valuable interaction between a diversity of stakeholders in order to make science have an impact on society." **R Belfon, PhD student at the University of West Indies, Trinidad and Tobago**

The summer school involved a team of skilled facilitators from a number of different organisations.

Participants took part in workshops relating to the release and absorption of greenhouse gases in agricultural systems, including sources and sinks of greenhouse gases; laboratory and field methods for measuring emissions; computer tools and models for estimating wide-scale and future emissions; and strategies for reducing greenhouse emissions from agricultural systems.

> "It was an excellent experience, because we took a wide outlook and approach to the new methodologies available and all the current research related to greenhouse gases. We also set up an experiments network in Latin America, in which I have the pleasure to participate, and I hope the results will be very promising." **Carolina Alvarez, National Agricultural Technology Institute (INTA) Argentina, and PhD student, National University of Cordoba in Argentina**

The summer school culminated with the design of a joint experiment, where participants devised methods to measure greenhouse gas emissions from livestock urine on improved and degraded pasture. The aim was that PhD students attending the course should finalize the experiment in their respective countries of Brazil, Colombia, Nicaragua, Argentina, and Trinidad and Tobago, and provide key data for validating computer simulation models.

Read more

- CCAFS Research: Low emissions agriculture
- CIAT Blog: Cambio climático, sistemas productivos y suelos, temas tratados en una escuela de verano diferente

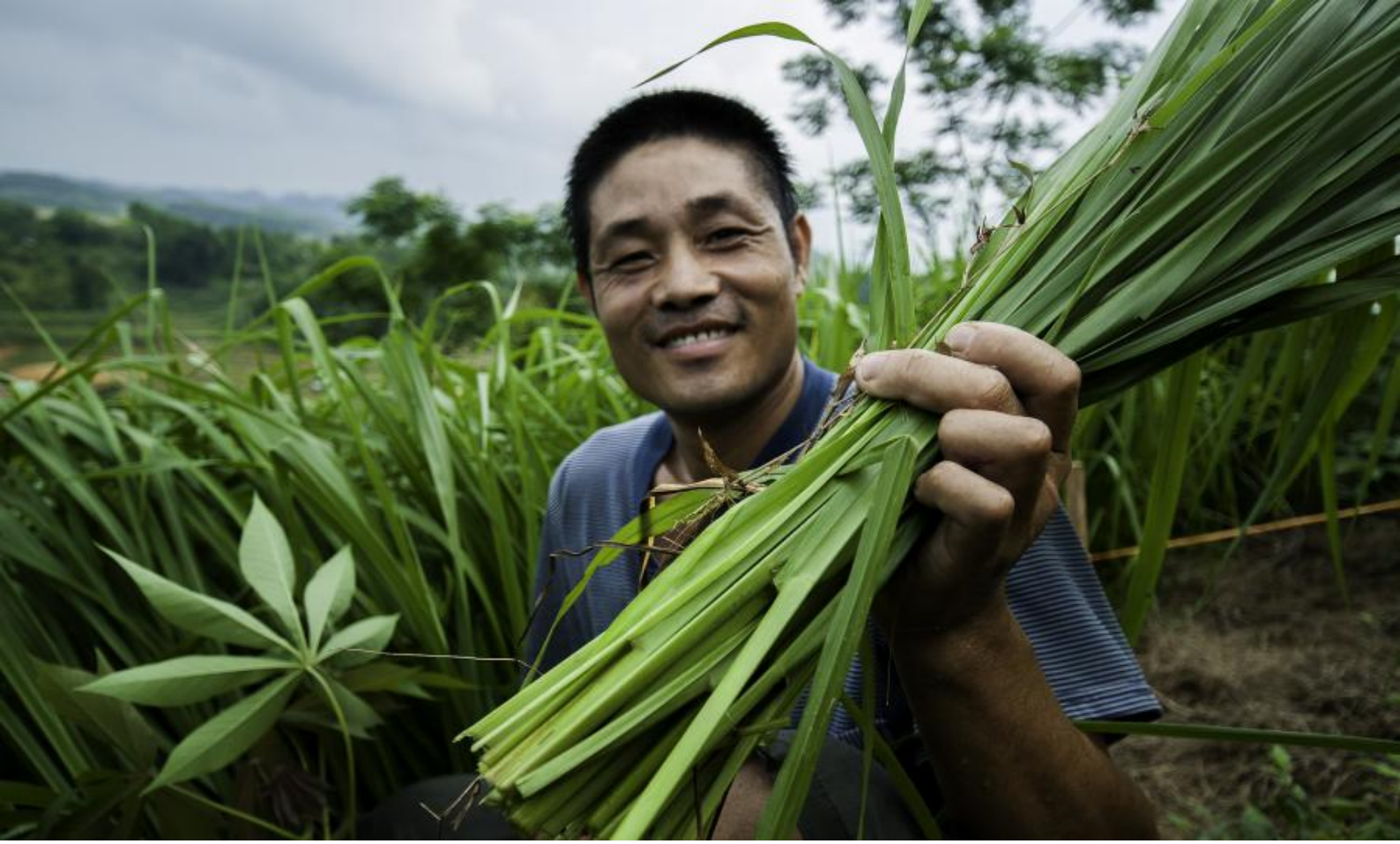

Photo: G. Smith (CIAT)

CAPACITY DEVELOPMENT AND INNOVATIVE COMMUNICATION

Cassava farmers learn intercropping lessons from their peers

When it comes to learning a new approach in farming, nothing beats first-hand experience. That's why, in 2015, a group of farmers in northeast Vietnam visited high-yielding cassava fields in a nearby district. The delegation, from Ma Village in Yen Binh District, travelled to Van Yen District where farmers practise a new way of growing cassava – one that produces good results despite climate change impacts, such as increased flash flooding.

Ma Village is one of several Climate-Smart Villages, designated by a partnership between CCAFS, the International Center for Tropical Agriculture (CIAT) and

community members as test beds for climate-smart agriculture. So, it made sense for farmers from the village to see for themselves farming adaptations that cope with the effects of climate change.

> "Why does cassava here look so much bigger and better than ours? How have they done it?!" **Farmer from Ma Village, Vietnam**

What the farmers found when they visited Van Yen was a system of intercropping where cassava is grown between grasses and tephrosia trees along 5–10 m contour lines. Van Yen farmers initiated this system in 2002 using grass varieties provided by CIAT. The idea behind the system was that it would improve soil quality and reduce the amount of erosion caused by intense periods of rainfall.

It seems that the system has done just that. Soil quality has improved remarkably – as cassava stems and leaves have been left to accumulate over time behind grass strips. The resulting increase in height of these grass strips (up to 1.0-1.2 m) has formed natural terraces where the soil is well aerated and rich in carbon content.

The farmers from Ma Village learned that the increase in soil quality in Van Yen has enabled cassava production to rise dramatically. Over 13 years, cassava yields have risen from 12 to 20 tonnes per hectare, with some farmers achieving 30 to 40 tonnes per hectare. On top of this, farmers can 'cut and carry' grass as forage to feed their cattle, for which there is insufficient grazing land in the district. Once cassava roots are harvested, the stems and leaves are left on the land surface as nourishing mulch during the off-season.

Motivated by the success they witnessed in Van Yen, the visiting delegation is keen to replicate cassava intercropping back in Ma Village. The visit, therefore, demonstrates how peer-to-peer learning is a vital contributor to the out-scaling of climate-smart farming systems.

Read more

- CIAT Blog: Seeing is believing: getting climate-smart in Vietnam
- Vinh BL et al. 2016. CSA targeting and priority setting process. CCAFS Working Paper [draft]

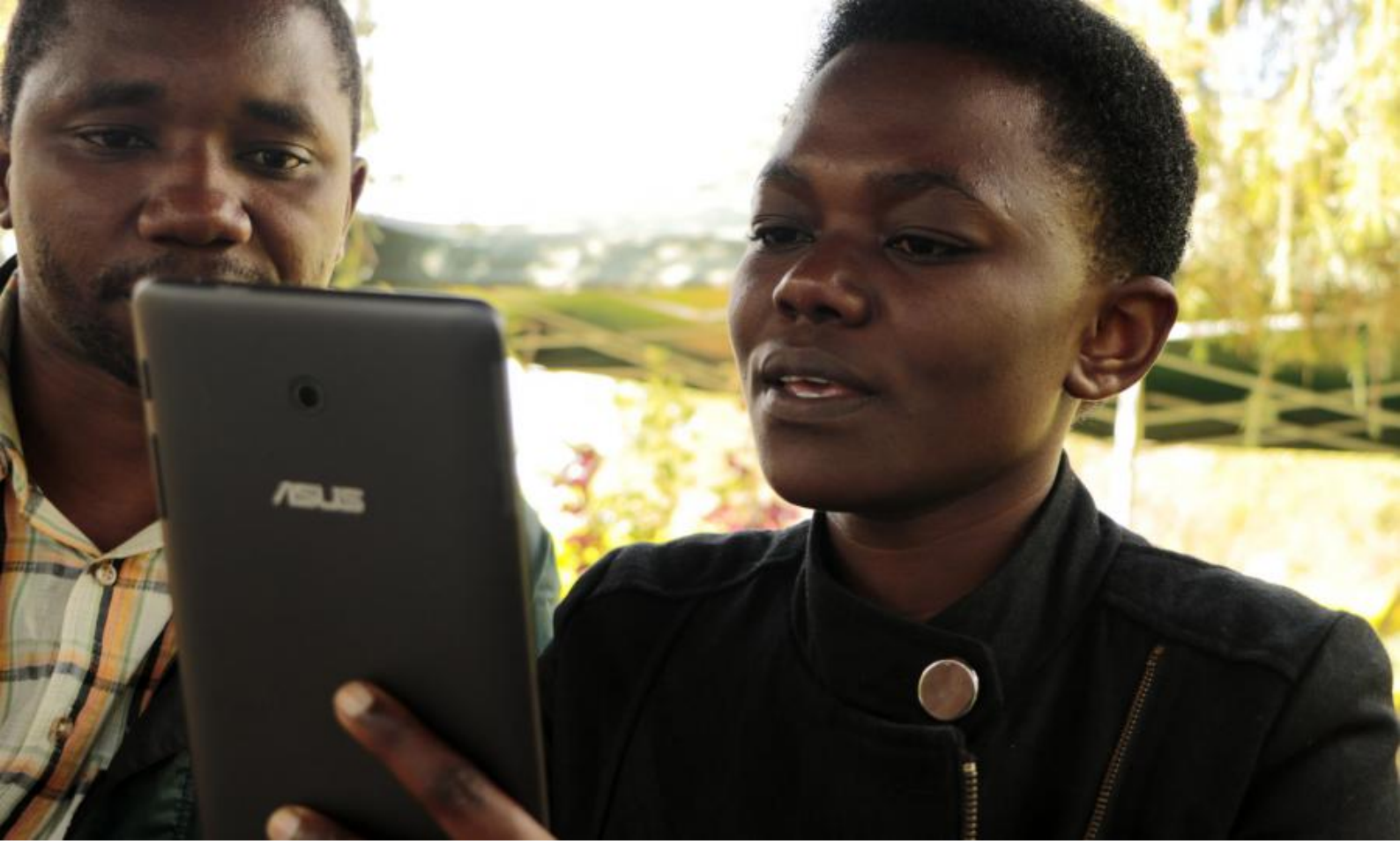

Photo: M. Koningstein (CIAT)

CAPACITY DEVELOPMENT AND INNOVATIVE COMMUNICATION

Policy and science meet online in Africa

Making sound agricultural policy decisions in Africa is not easy. Weather patterns are changing due to the effects of climate change, and to withstand this variability farming communities need to change too. So, how can policymakers provide the best guidance for farmers in such complex circumstances?

A new online platform aims to help. Formed by CCAFS, the Common Market for Eastern and Southern Africa (COMESA), the Rockefeller Foundation and Pamoja Media, the Climate and Agriculture Network for Africa (CANA) is a knowledge-sharing platform that bridges the gap between agricultural science and policy. CANA means that policymakers can guide farmers with decisions based on the best available evidence.

Collating a range of scientific research pertinent to farming livelihoods in Africa, CANA provides a 'one stop shop' for policymakers. The platform includes a section dedicated to climate-smart agriculture plus other sections on: building resilience to climate change; low emissions development; financing climate change adaptation; policies for adaptation; and gender and equality.

> "This is an amazing opportunity that brings scientific evidence direct to policy makers." **James Kinyangi, CCAFS East Africa Programme Leader**

To boost the sharing of information among policymakers and scientists, CANA has extended its reach through Facebook and Twitter. These are actively used to further share materials like reports, blog stories, news articles and videos, and opportunities for learning such as webinars and symposiums.

The CANA platform itself had 9 505 views in total in 2015. During the year, CANA's interactive online sessions were in high demand, with participants signing up to receive regular updates and take part in discussions. Also in 2015, CCAFS and the International Livestock Research Institute (ILRI) conducted a training workshop and a webinar to build regional capacity on the use of the CANA platform.

More than 100 people from research, policy and training organizations attended the CANA training workshop, and the webinar attracted around 150 participants, with another 350 people expressing interest in receiving the webinar report.

Read more

- CCAFS Blog: Introducing Africa's bridge between science and policy

Photo: C. Schubert (CCAFS)

CAPACITY DEVELOPMENT AND INNOVATIVE COMMUNICATION

Weather-smart phone apps, weather-smart farmers

Survey after survey has shown that farmers want to get their hands on sound information on what to expect weather-wise. CCAFS scientists at the Walker Institute, Reading University, have researched ways to capitalize on increasingly affordable smart phones and tablets to respond to this demand. But farming is very location-specific. The Participatory Integrated Climate Services for Agriculture (PICSA) approach developed by CCAFS has already helped thousands of farmers in sub-Saharan Africa make informed decisions based on locally relevant weather and crop information. Given the success of PICSA, a CCAFS team set out to develop mobile phone apps that deliver better information about weather and climate for a particular area.

In 2015, scientists developed 2 apps for non-government staff, extension officers

and seed suppliers to use when advising farmers in Ghana, Malawi and Tanzania. Previous research had shown that trusted intermediaries who understand local conditions can help farmers interpret complex weather and climate information.

The first app, Historical Climate Tool, allows users to select information on extremely wet or dry years, or long or short seasons in a specific location and to find out the probability of these events recurring in the near future. Based on the probable weather, farmers can consider crop and livestock options. The second app, Participatory Budget Tool, allows farmers to compare budgets for the different options, with easy-to-use features like a drag-and-drop interface, budget templates and an automatic cash balance calculator.

> "Through participatory planning methods and budgets, [farmers] are encouraged to decide how to use their new knowledge based on what works for them." **Peter Dorward, Project Leader, University of Reading**

Staff of the Adventist Development and Relief Agency (ADRA) field tested the 2 apps with groups of 30–40 male and female farmers in 6 communities in northern Ghana. Irrespective of literacy levels, farmers were able to use the apps successfully.

The research showed that the prospects for providing farmers with timely, locally relevant weather information through the 2 mobile phone apps are good. The demand is there. Once trained by staff of non-governmental organizations or extension officers, farmers would be able to use the intuitive, user-friendly apps to get better results from their efforts.

Read more

- CCAFS Event: Online launch of the participatory climate information services for agriculture manual
- Caine A et al. 2015. Review of mobile applications that involve the use of weather and climate information: their use and potential for smallholder farmers. CCAFS Working Paper No. 150
- Thomson Reuters Foundation News Blog: Farmers need climate information services they can use

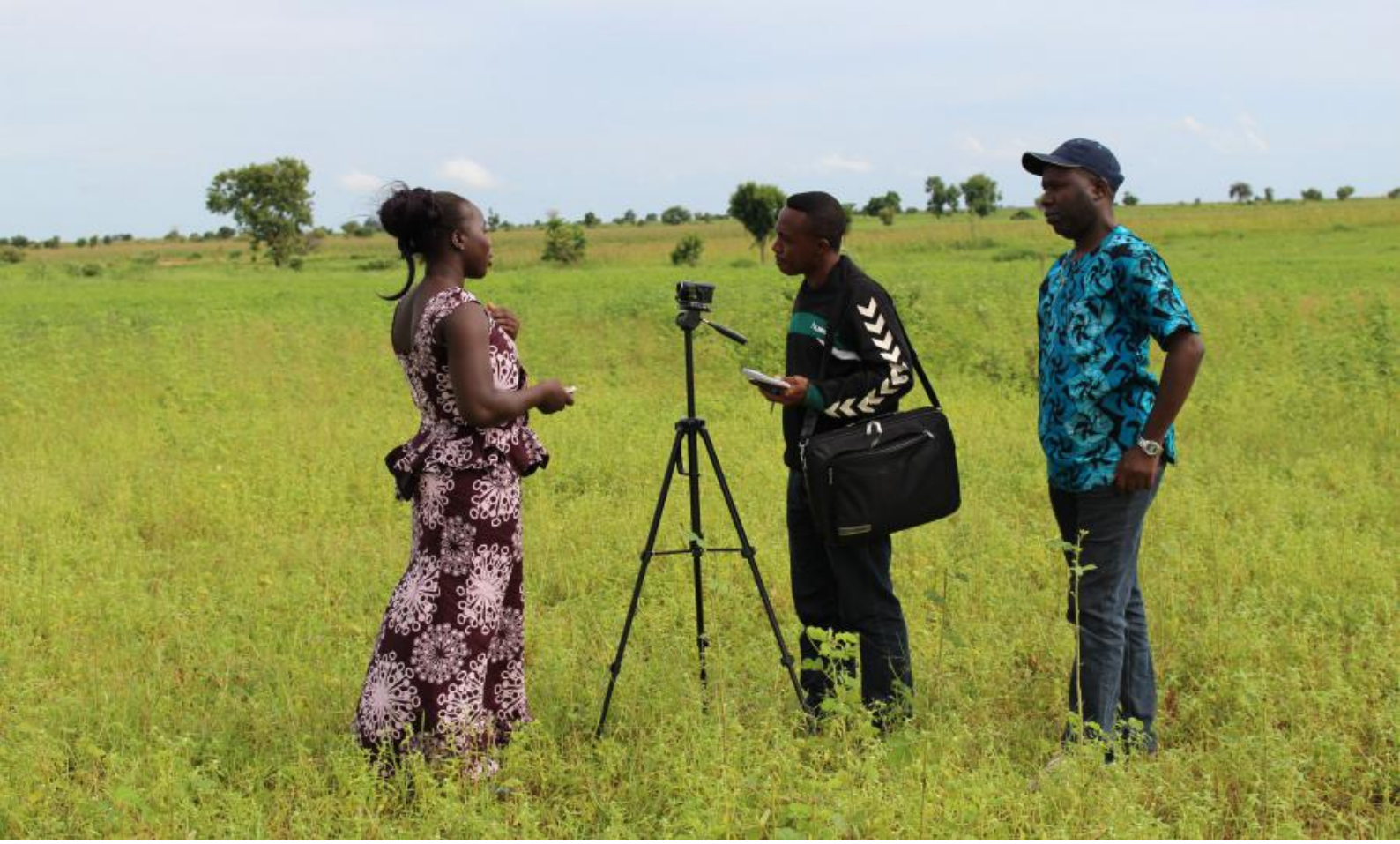

Photo: V. Meadu (CCAFS)

CAPACITY DEVELOPMENT AND INNOVATIVE COMMUNICATION

Inspiring journalists to communicate climate change

Popular media can be a powerful channel for sharing information on climate change. To cover climate change issues and report accurately to readers, listeners or viewers, journalists need to understand climate change science. Journalists play a key role in providing information that helps leaders and the public decide what needs to be done about climate change, when action should be taken and how much they are prepared to pay. The uncertainties, complexities and time frames of climate change, however, can be hard for journalists to unravel.

In 2015, CCAFS teams in Southeast Asia, West Africa and Latin America organized workshops and seminars for journalists on communicating climate change. The journalists listened to scientists, asked questions, visited field sites, wrote

stories, role-played selling stories, made videos and produced ready-to-air broadcasts in local languages. In Vietnam, a field trip led by the International Rice Research Institute (IRRI) to CCAFS research sites included visits to experiments on tea, livestock, crops and soil fertility to show adaptation measures currently being tested. In Senegal, journalists met farmers who were benefiting from timely climate forecasts provided by mobile phone and rural radio, and discussed technical aspects with scientists and extension agents who had devised the forecasts. In Latin America, a series of workshops were hosted by the CCAFS team at the International Center for Tropical Agriculture (CIAT). Journalists who attended the workshops, formed a network to allow them to continue to share news, tips and useful links on science journalism, and information on agriculture and climate change.

> "terrific"; "make us think in new places and approaches to find stories"; "new sources of information." **Participants, media workshop, Tegucigalpa, Honduras, October 2015**

Engaging the media is at the heart of CCAFS communication. The media provide a vital link not only between researchers and policy makers, but also between researchers and farmers, for example by raising awareness of how the traits of different varieties, such as drought-tolerance or disease-tolerance, can help deal with climate change.

> "Through the help of the media, we hope to engage policymakers and key stakeholders to include agriculture in the climate change and agriculture agenda and to mobilize stakeholders for collective action toward mitigation and adaptation." **Leocadio Sebastian, Regional Program Leader, CCAFS South-East Asia**

Workshops for media professionals in Cambodia, Vietnam, Laos, Philippines

- 199 media professionals trained in science-based climate change reporting
- 109 subsequently trained by a public–private partnership with Metro-Pacific Investment Corp in 4 provinces in the Philippines

Workshops for media professionals in Colombia, Guatemala, Honduras

- 20 media professionals trained (12 female, 8 male)
- 9 CCAFS media outreach pieces produced by participants
- Hashtag #ComuniCACC shared in 223 posts by 33 users, reaching 36 183 and 435 973 impressions
- Membership of Latin American Science and Agriculture Communications Network rose to 39

Training and field trip in Senegal

- 12 media professionals trained, resulting in 16 stories in international, regional and national media

Read more

- Navarro R et al. 2015. Mobilizing science for climate change, agriculture and food security: engaging the Southeast Asian media. CCAFS Working Paper No. 157
- CCAFS Blog: Laotian media professionals trained in climate change
- IRRI Blog: CCAFS-SEA kicks off first media workshop on how to report about climate change with impact
- CCAFS Blog: Tune in: Philippine rural broadcasters to promote climate-smart agriculture
- CCAFS Blog: Brainstorming with the media on climate change in Vietnam
- CCAFS Blog: Reporting on climate change: developing capacity in Senegal's media

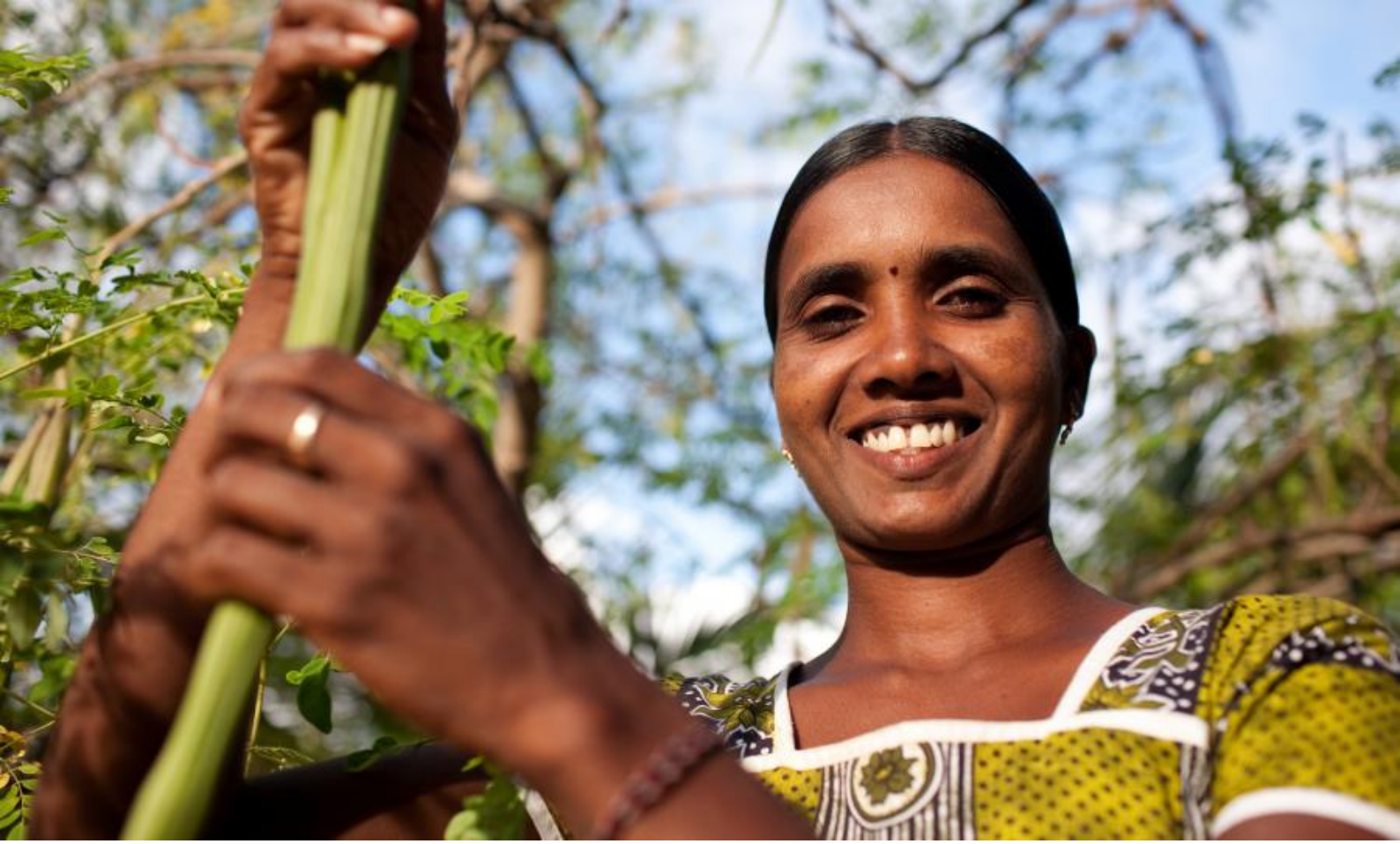

Photo: T. Greenwood (Oxfam Australia)

CAPACITY DEVELOPMENT AND INNOVATIVE COMMUNICATION

Country profiles map pathways to climate-smart agriculture

Policymakers need short, easy-to-read information to help them spot opportunities, prioritize action and make decisions. Responding to this, CCAFS scientists produced a set of visually engaging and highly factual profiles of the current state of climate-smart agriculture in 12 countries and counting. The profiles, for countries in sub-Saharan Africa, South Asia and Latin America, sum up challenges to agriculture and how climate-smart practices can help adapt to climate change and mitigate its effects. They are the product of months of in-depth research reviews, findings from surveys and responses to interviews with country experts.

Developed by researchers from the International Center for Tropical Agriculture (CIAT), and partners at the World Bank and Centro Agronómico Tropical de

Investigación y Enseñanza (CATIE), Costa Rica, the profiles differ from country to country. The profiles of some countries provide information on the opportunities that are available and actions that could take advantage of the opportunities. The profiles of other countries look at policies, plans and actions underway, showing what has been achieved and what remains to be addressed.

> "[Country profiles help] to move the dialogue, to improve knowledge or to focus potential actions." **Marc Sadler, Adviser on Risk and Markets, World Bank Agriculture Global Practice**

The country profile for Kenya, for example, shows that livestock generate 96.2% of agricultural greenhouse gas emissions, information that points to the livestock sector as a promising area for introducing climate-smart practices.

The Rwanda country profile shows that only a few farmers have adopted climate-smart practices, indicating a clear need for incentives.

The profile for Sri Lanka shows that there are synergies between research, development and extension programmes. Such synergies can facilitate and support the adoption of climate-smart technologies and practices that mitigate the effects of climate change and raise productivity. The profile for Uruguay shows that bilateral and multilateral international financial institutions already cooperate with Uruguay in initiatives related to climate change. Although none of this cooperation specifically addresses climate-smart agriculture, it presents opportunities to adapt agriculture to become more resilient.

What is clear from the research underpinning the profiles is that climate-smart agriculture is not a package of solutions, but an approach that helps a country to transform and reorient agriculture to support development and ensure food security in a changing climate. Because countries are at different stages of development and tackle development in different ways, the profiles will help guide different pathways towards climate-smart agriculture. Further profiles are now being developed at the request of countries, including profiles of sub-national districts.

Read more

- CCAFS Blog: New, quick and easy to read country profiles prove climate-smart agriculture is the way forward
- CCAFS Blog: New Latin America country profiles open pathways for reaching climate-smart agriculture
- CCAFS publications: CSA Country Profiles

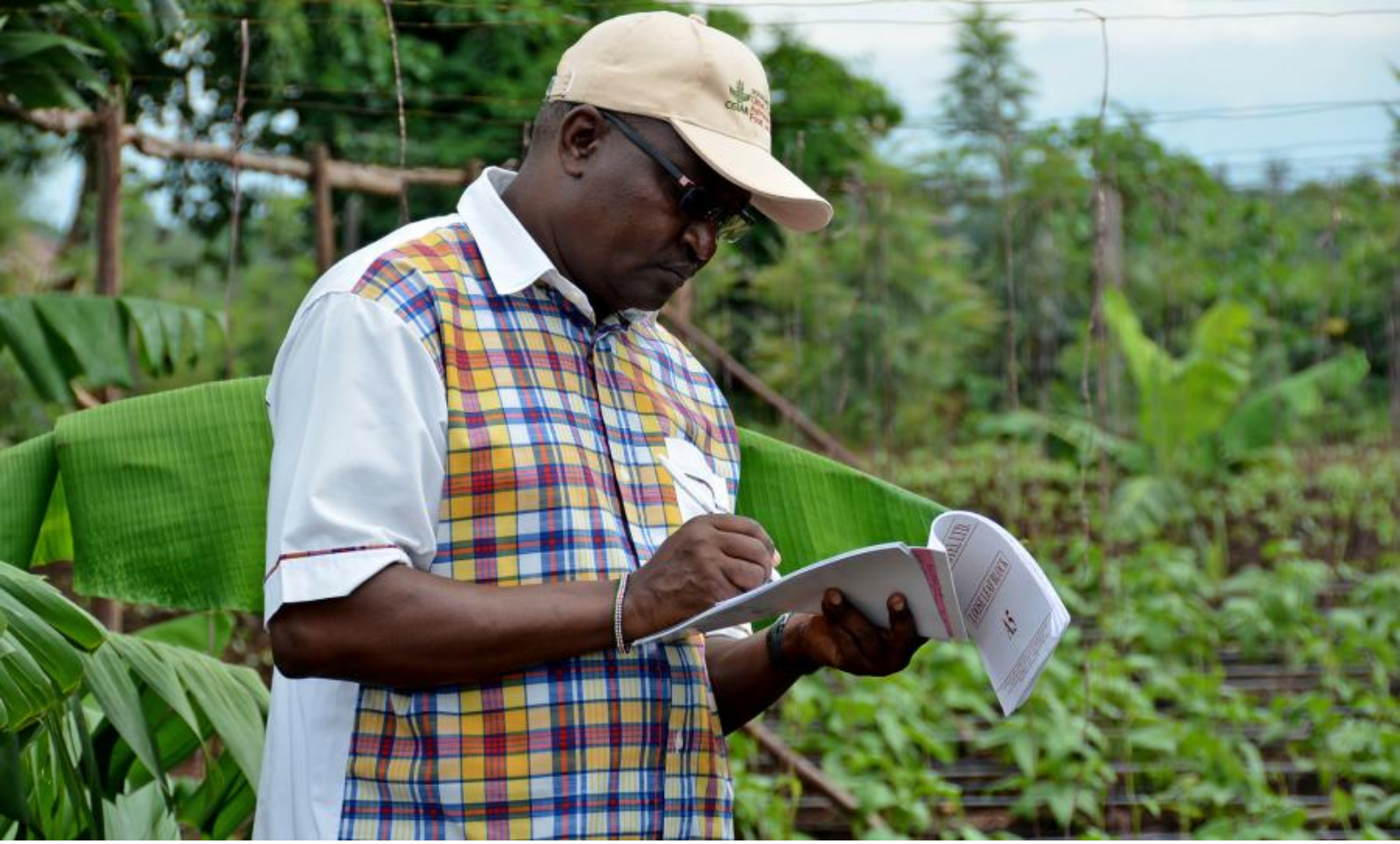

Photo: S. Kilungu (CCAFS)

BREAKTHROUGH SCIENCE AND INNOVATION

Weather forecasts support food security and disaster management in East Africa

To help address devastating extreme climate events such as droughts and floods in the Horn of Africa, the Intergovernmental Authority on Development (IGAD) Climate Prediction and Applications Centre (ICPAC) was set up to provide climate early warning and associated information to member countries. However, in the past, the ICPAC could only provide seasonal climate forecasts within 3 general expected rainfall categories: 'above normal', 'near normal' and 'below normal'. This kind of forecasting lacked the specific details of how much rain to expect and when, which is what rural communities and their support services in East Africa really needed to know.

Integrated agricultural production and food security forecasting system from CCAFS | CGIAR program - Climate Change, Agriculture and Food Security

But all this changed with the launch in 2015 of the Integrated Agricultural Production and Food Security Forecasting System for East Africa (INAPFS) project, led by the International Maize and Wheat Improvement Center (CIMMYT) and supported by CCAFS. INAPFS is a multi-partner initiative involving not only ICPAC, CIMMYT and CCAFS, but also the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), the International Center for Tropical Agriculture (CIAT), the Famine Early Warning Systems Network, the UN World Food Programme and the Partnership for Economic Policy, as well as national weather services, disaster risk management centres and food security offices in project countries.

Building on existing tools, the project has developed a robust, scientifically sound and user-friendly forecasting system that integrates improved seasonal climate, production and food security forecasts.

Challenges & Opportunities in Sharing Early Warning Information and ICPAC's Support to Specific Sector Applications von CCAFS | CGIAR program - Climate Change, Agriculture and Food Security

Thanks to the new project, ICPAC can now forecast how much rain will fall on both a seasonal and monthly basis and can effectively communicate this information to national and regional policymakers, agriculturists, meteorological and hydrological services, disaster management and food security offices and non-government organizations. These organizations can, in turn, advise farmers.

INAPFS will provide accurate and spatially disaggregated early warnings to local and national governments and relief agencies, enabling them to respond to climate crises in a timely and efficient manner.

> "When policy makers have the right information, they make the right decisions and take the right actions." **Bwango Apuuli, IGAD Climate Prediction and Applications Centre (ICPAC)**

Through this improved forecasting service, ICPAC is able to enhance the ability of East African communities to cope with current extreme weather events, events which are projected to increase in frequency and severity with climate

change. This impact is just one outcome of a wider regional CCAFS programme that is working to help rural communities in East Africa become food and nutrition secure by 2025.

> "Climate related disasters, such as droughts, are among the reasons behind the ever-increasing food insecurity that has persisted for ages in the Greater Horn of Africa region. When policy makers have the right information, they make the right decisions and take the right actions." **Guleid Artan, Director of the Climate Prediction and Applications Centre (ICPAC) of the Intergovernmental Authority on Development (IGAD)**

Read more

- CCAFS Blog: Accurate, timely early warning systems for east African policy makers now possible
- CIMMYT Blog: CIMMYT-CCAFS initiative seeks to achieve food and nutrition security in east Africa by 2025

Photo: N. Palmer (CIAT)

BREAKTHROUGH SCIENCE AND INNOVATION

New guidelines reduce the cost of measuring emissions from agriculture

Field measurement of agricultural greenhouse gas (GHG) sources and sinks in developing countries is fraught with difficulties, as landscapes are often parcelled into tiny plots with a vast array of different land uses. To deal with this, researchers must take into account the need for low-cost measurement methods that can be easily deployed and used in the field. The newly available Standard Assessment of Agricultural Mitigation Potential and Livelihoods (SAMPLES) measurement guidelines and database offer means to deal with these challenges.

SAMPLES, created by CCAFS and a range of partners led by the Gund Institute for Ecological Economics, University of Vermont, enables compilers of GHG inventories, developers of mitigation projects, researchers and students in developing countries to better quantify emissions and mitigation potential. This, in turn, helps farming communities take action to reduce their GHG emissions and mitigate agriculture's contribution to climate change.

Several innovative approaches in SAMPLES help users reduce the costs of collecting agricultural GHG data. For example, a major difficulty in measuring emissions from soils (such as nitrous oxide given off when fertilizer is applied) is that it involves processing many gas samples. The SAMPLES guidelines describe a new approach, validated by CCAFS researchers, that allows gas samples to be pooled prior to processing, greatly reducing the costs involved.

The SAMPLES guidelines also describe all the potential methods that may be used for a particular GHG source or sink, and compare these in terms of cost, complexity and suitability for different situations. There are, for example, many different ways of measuring methane emitted by ruminant livestock. Respiration chambers are the 'gold standard', but are expensive and not suited to grazing animals, so the guidelines also describe cheaper alternatives.

Standard Assessment of Agricultural Mitigation Potential and Livelihoods our common future 2015 from CCAFS | CGIAR program - Climate Change, Agriculture and Food Security

Equally important, the SAMPLES platform contains a new database where compilers of GHG inventories, and those developing mitigation actions can find out about country-specific emission factors entered by CCAFS researchers. Other scientists can also upload their own data. There is clearly great demand for this guidance – since the SAMPLES platform launched in June 2015, it has had nearly 10 000 page views and over 1 000 downloads of the guidelines.

Read more

- Website: SAMPLES: Standard Assessment of Agricultural Mitigation Potential and Livelihoods
- CCAFS Research: Low emissions agriculture: standard assessment of agricultural mitigation potential and livelihoods
- CCAFS Research: Low emissions agriculture: quantifying agricultural emissions

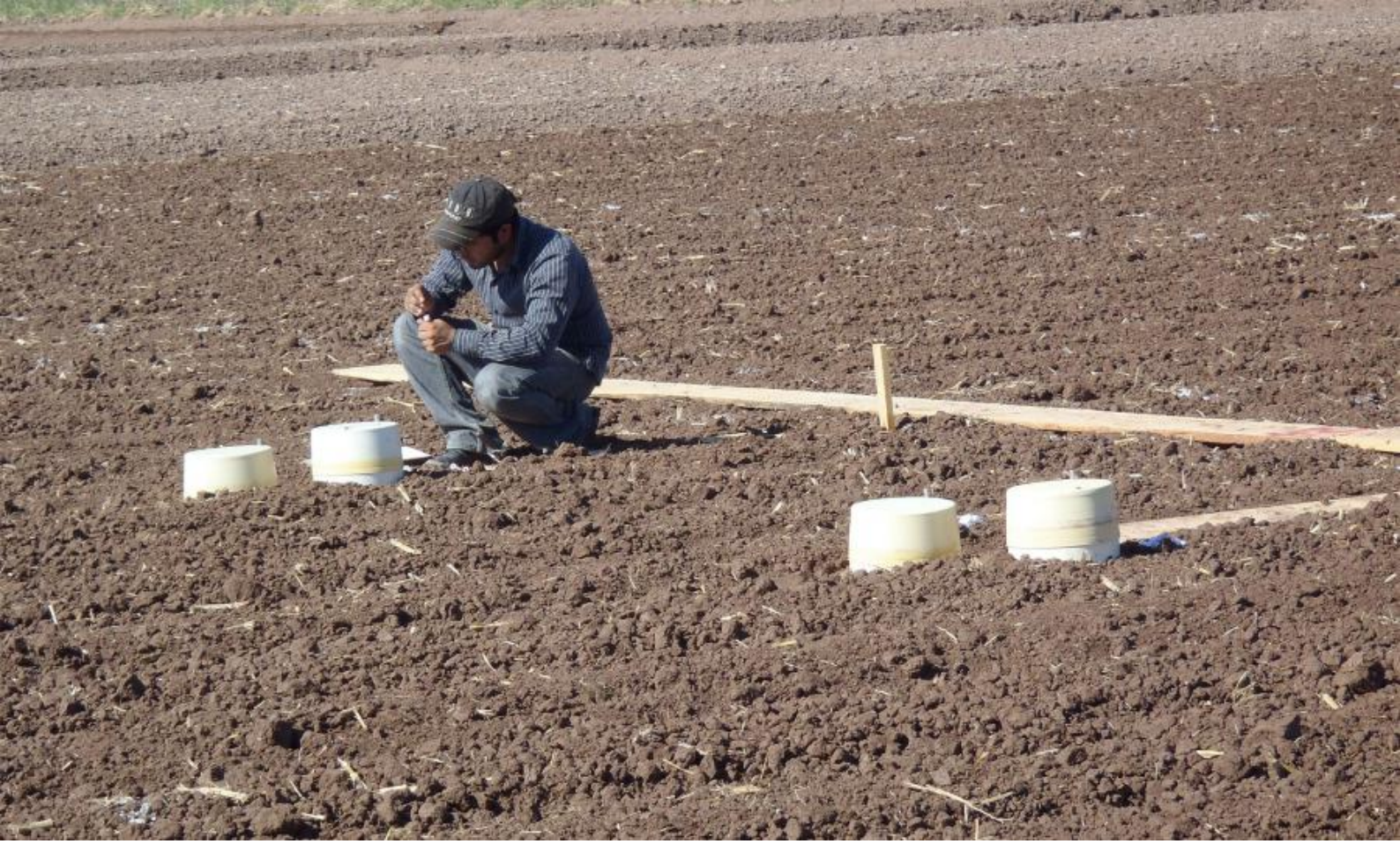

Photo: CIMMYT

BREAKTHROUGH SCIENCE AND INNOVATION

Less fertilizer, same crop yields

Nitrogen fertilizers are a significant source of the greenhouse gas nitrous oxide (N_2O). But farmers are often reluctant to reduce their fertilizer rates for fear of reducing crop yields and losing income. In the case of spring wheat fields in Mexico, however, CCAFS and the International Maize and Wheat Improvement Centre (CIMMYT) have found that applying less nitrogen fertilizer can significantly curtail N_2O emissions without reducing yield.

These findings are particularly important for Mexico, as 80% of wheat production in the country comes from irrigated conditions, where excess nitrogen fertilizer is applied.

The researchers, working in collaboration with the University of Michigan,

measured N2O outputs from irrigated spring wheat in northwest Mexico fertilized at 5 nitrogen rates during 2 growing seasons. Emissions of N2O increased following soil management activities, especially the application of nitrogen fertilizer, and particularly when this input exceeded crop requirements.

Below average emissions of N2O were measured when the volume of fertilizer used was not enough to produce a good crop. However, substantially higher than average emissions were found when an excess of fertilizer was applied – more than was needed to produce an optimum yield. This exponential response, consistent with other crops, suggests large decreases in N2O emissions are possible with lower nitrogen inputs and without any negative impact on yield.

> "With fertilizer use patterns in the Yaqui Valley a likely gauge for high-productivity irrigated cereal systems elsewhere, our results provide evidence for a win–win–win scenario – large reductions in agricultural greenhouse gas emissions, increased farmer incomes and maintained or even improved productivity." **Ivan Ortiz-Monasterio, Senior Scientist in the Wheat Program at CIMMYT**

The Mexico study used these findings to inform management strategies for mitigating N2O emissions without compromising productivity and economic returns. It also explored opportunities for farmers to take advantage of global carbon markets, and generate income from any improvements in nitrogen management they adopt.

Read more:

- Verhulst N et al. 2014. Nitrogen use efficiency and optimization of nitrogen fertilization in conservation agriculture. CIMMYT Report

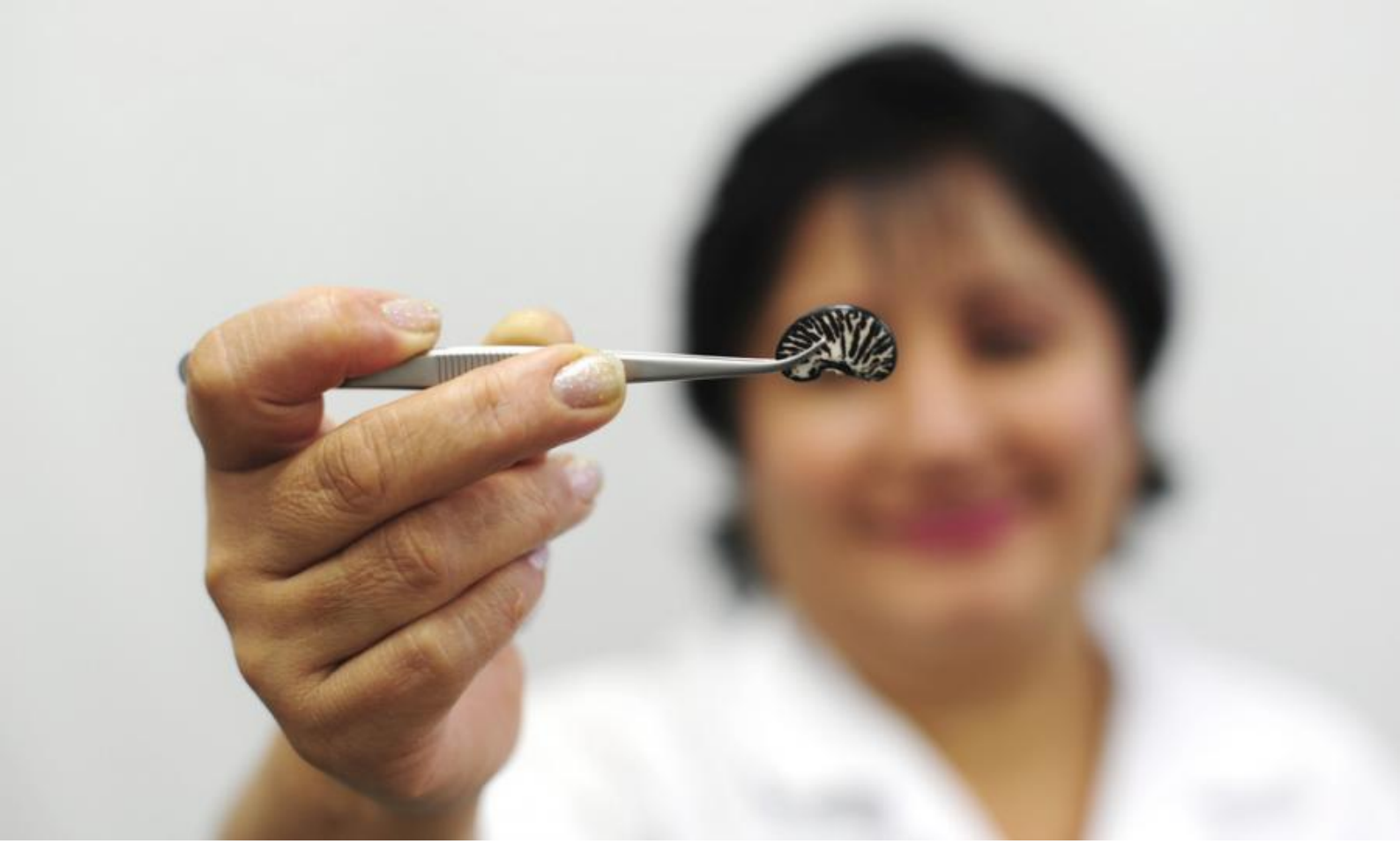

Photo: N. Palmer (CIAT)

BREAKTHROUGH SCIENCE AND INNOVATION

Climate-proof beans yield hope for farmers

Despite hotter conditions challenging agriculture in many parts of the world, new types of 'heat-beater' beans may allow current bean growing areas to continue producing the crop during the entire 21st century under most global warming scenarios. This is according to recent modelling analyses by CCAFS partners.

> "This discovery could be a big boon for bean production because we are facing a dire situation where, by 2050, global warming could reduce areas suitable for growing beans by 50 percent." **Steve Beebe, Senior Bean Researcher, International Center for Tropical Agriculture (CIAT)**

The 'heat-beater beans' were identified by researchers in a scientific

collaboration between CCAFS, the CGIAR Research Program on Grain Legumes and the International Center for Tropical Agriculture (CIAT). These new lines of beans have a strong tolerance to temperatures 4°C higher than the range that beans can normally tolerate. This offers the potential to adapt bean production in Africa and Latin America to increasing temperatures caused by climate change.

Previous modelling research in 2011, using a range of climate scenarios, had predicted that, over the next several decades, higher temperatures will become the primary threat to bean production. Introducing heat stress tolerance into bean genetic material was therefore recognized as a top breeding priority.

With these findings, the Bean Program at CIAT, with funds from CCAFS and the CGIAR Research Program on Grain Legumes, made crosses of common bean and tepary bean (another type of bean known for its heat tolerance). Field tests of breeding lines in Colombia, as well as in the high-temperature greenhouses at CIAT, revealed that around 30 lines held the heat tolerance genes that were much needed for climate change adaptation.

The lines are being further advanced in CIAT breeding trials to introduce all the other preferred characteristics – such as seed size and colour – that are key for adoption by farmers.

Read more:

- CGIAR News Blog: Discovery of beans that can beat the heat could save "meat of the poor" from global warming
- Ramirez-Villegas J & Thornton PK. 2015. Climate change impacts on African crop production. CCAFS Working Paper No. 119
- Gaur PM et al. 2015. High temperature tolerance in grain legumes. Legume Perspectives no. 7. pp 23–24
- BBC News: Hope grows for climate-proof beans

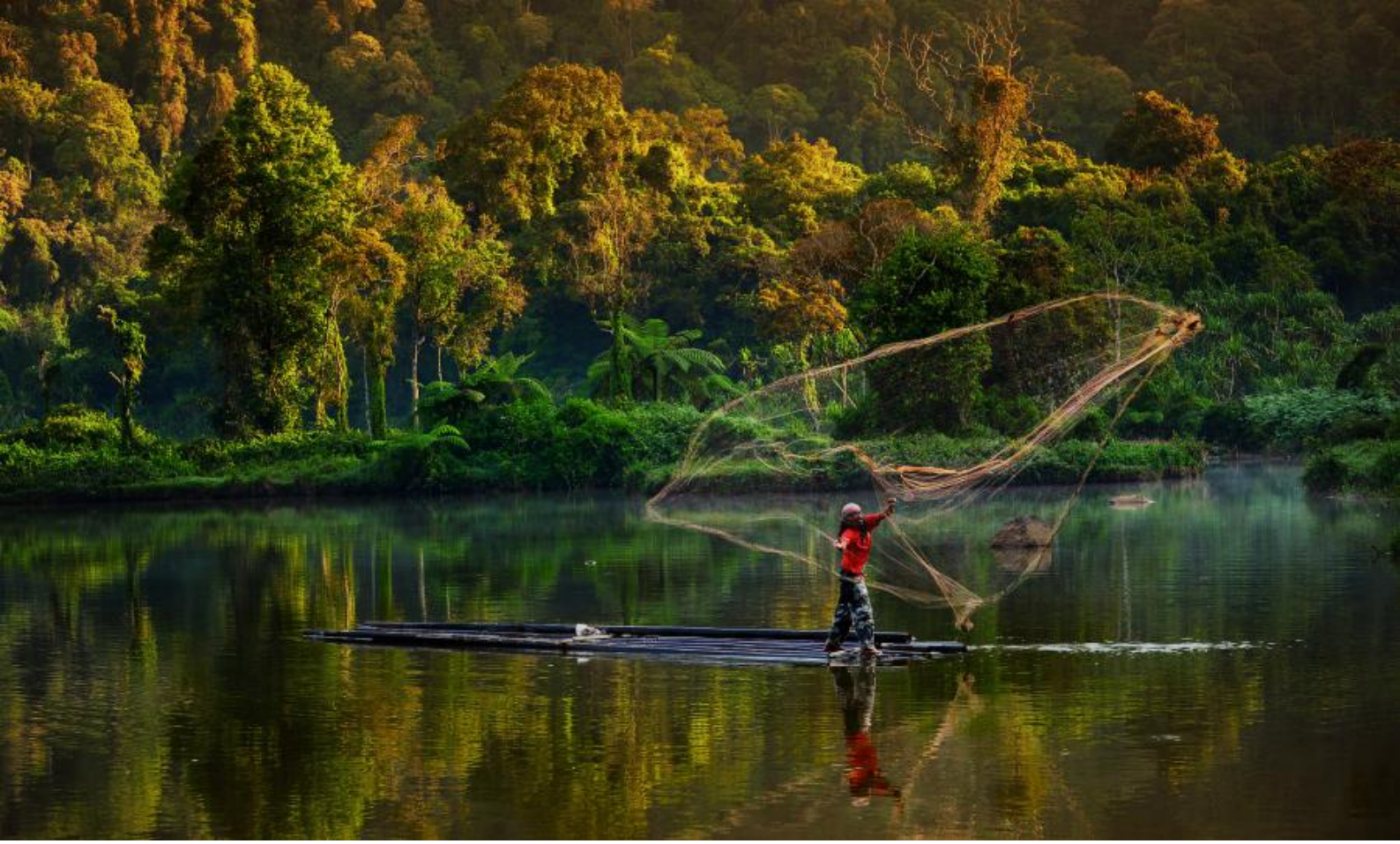

Photo: R. Martin (CIFOR)

BREAKTHROUGH SCIENCE AND INNOVATION

Mapping gaps in crop yields helps boost production to meet booming demand

With the world's population on course to pass 9 billion by 2050, agronomists and farmers need ways to sustainably increase food supplies. Globally, current yield increases for major food crops are not keeping pace with booming demand. There is limited land suitable for crop production, and so ensuring the world has enough to eat while protecting carbon sinks – rainforests, wetlands and grasslands – depends on achieving the highest possible yields on existing farmland.

But to close yield gaps, scientists need to know what and where those yield gaps

are. That's why researchers from the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), together with 12 country agronomists and partners at various research organisations, developed the first easily accessible, reproducible and agronomically accurate web-based platform to estimate exploitable gaps in crop yields.

The Global Yield Gap Atlas (GYGA) website enables farmers, governments, policymakers, research institutions, private sector organizations and others to identify regions with the greatest potential to sustainably increase global food supplies. The Atlas is a powerful tool for improving the efficiency of agronomic research, as well as supporting strategic planning and policy development for food security at local, national and global scales.

Even in data-rich regions such as the USA and Europe, there is a dearth of information on yield potential. In the less developed, major crop-producing regions of the world, the need for reliable estimates of yield gaps is more urgent and is based on robust estimates of rainfed and irrigated yield potential and of actual yields.

The target of the Atlas is to provide the best available estimates of exploitable yield gaps in all countries. At this early stage, it provides data for 10 selected countries in sub-Saharan Africa and 2 in South Asia. Agronomists on the ground in these 12 locations have the skills to perform yield gap assessments and lead efforts to identify the most suitable sources of data in their countries.

Read more

- Website: Global Yield Gap Atlas

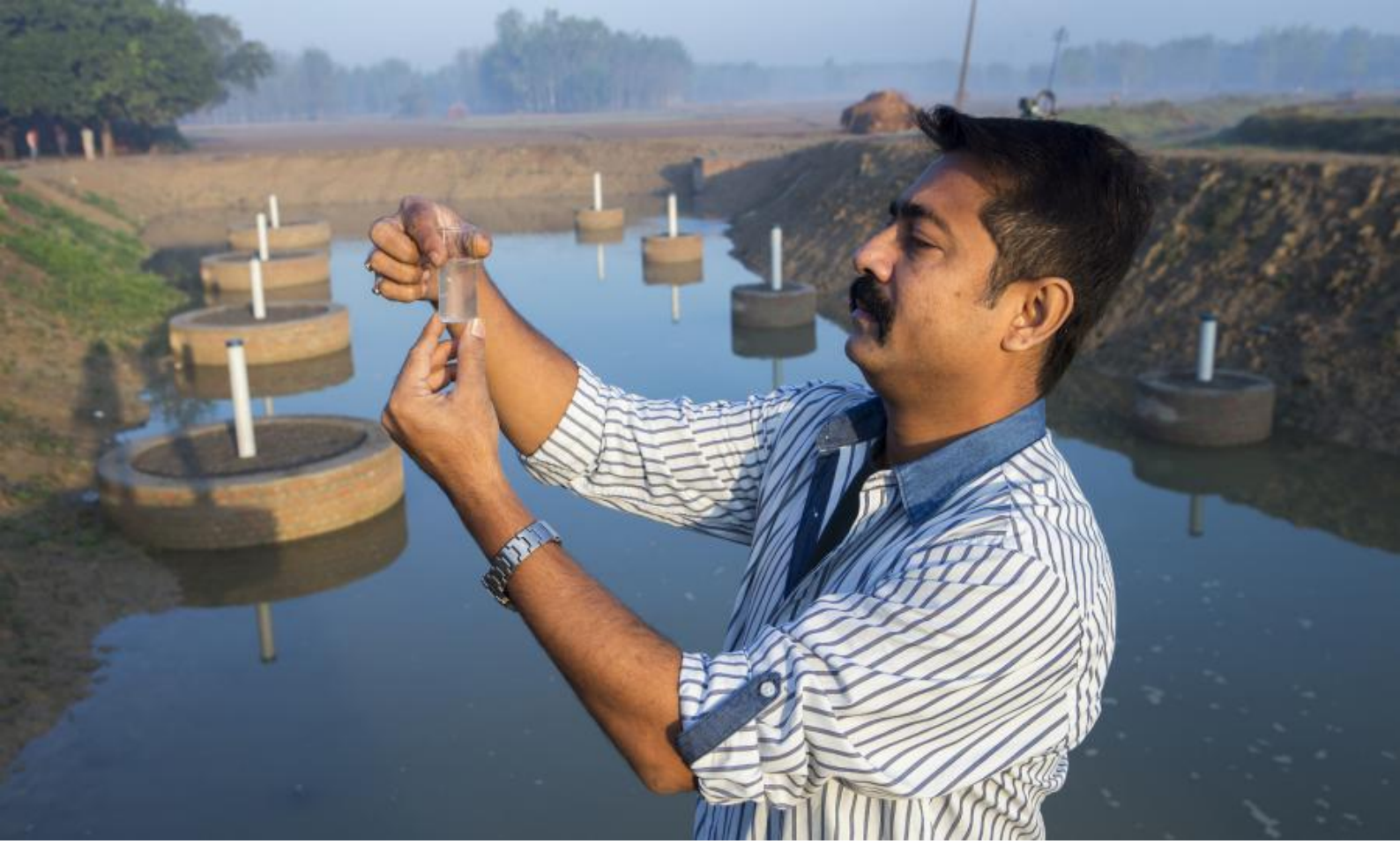

Photo: P. Vishwanathan (IWMI)

BREAKTHROUGH SCIENCE AND INNOVATION

Taming floods by sending water underground

Ninety-five per cent of all the people worldwide affected by floods and droughts live in Asia. The Ganges River Basin, in India and Bangladesh, is particularly hard hit. Here, around 400 million people live at the mercy of regular floods and droughts, the intensity of which is exacerbated by climate change.

During the rainy season, large volumes of excess water run off the Himalayan mountain range into the Ganges River, often causing great damage downstream. In drier times of the year, people face water shortages, made worse by groundwater extraction to support intensive agriculture.

To help deal with this variability, CCAFS has been working with experts at the International Water Management Institute (IWMI) to develop a means of

capturing excess water during rainy periods and store it in natural aquifers underground.

The innovation – called the Underground Taming of Floods for Irrigation (UTFI) – was put into action in 2015 in a pilot project near Rampur, in Uttar Pradesh, India. The aim here was to revolutionize flood management while at the same time boosting groundwater stocks for dry season irrigation.

UTFI channels surplus surface water from flood□prone rivers to a small reservoir, or 'pond'. Deep wells, drilled into the floor of the pond, allow the water to quickly drain below ground, where it infiltrates the aquifer. This water can then be pumped back up again by farmers during the dry season so they can maintain or intensify their crop production.

> "This is an exciting concept which has never really been done before and whose benefits go directly to local and wider communities. Putting [UTFI] into practice will save on the large funds spent each year on relief and restoration efforts of flood victims and on subsidies for groundwater extraction during the non□rainy season. We hope our approach would tackle the root causes of the problem rather than the consequences."
> **Paul Pavelic, groundwater specialist at IWMI**

From its beginnings in Uttar Pradesh, CCAFS, IWMI and partners aim to scale up UTFI, protecting lives and assets downstream, boosting agricultural productivity and helping poor communities deal with the increasing rainfall variability brought about by climate change.

Read more

- Smakhtin V et al. 2015. Managing water variability, from floods to droughts. IWMI Brief for GSDR 2015

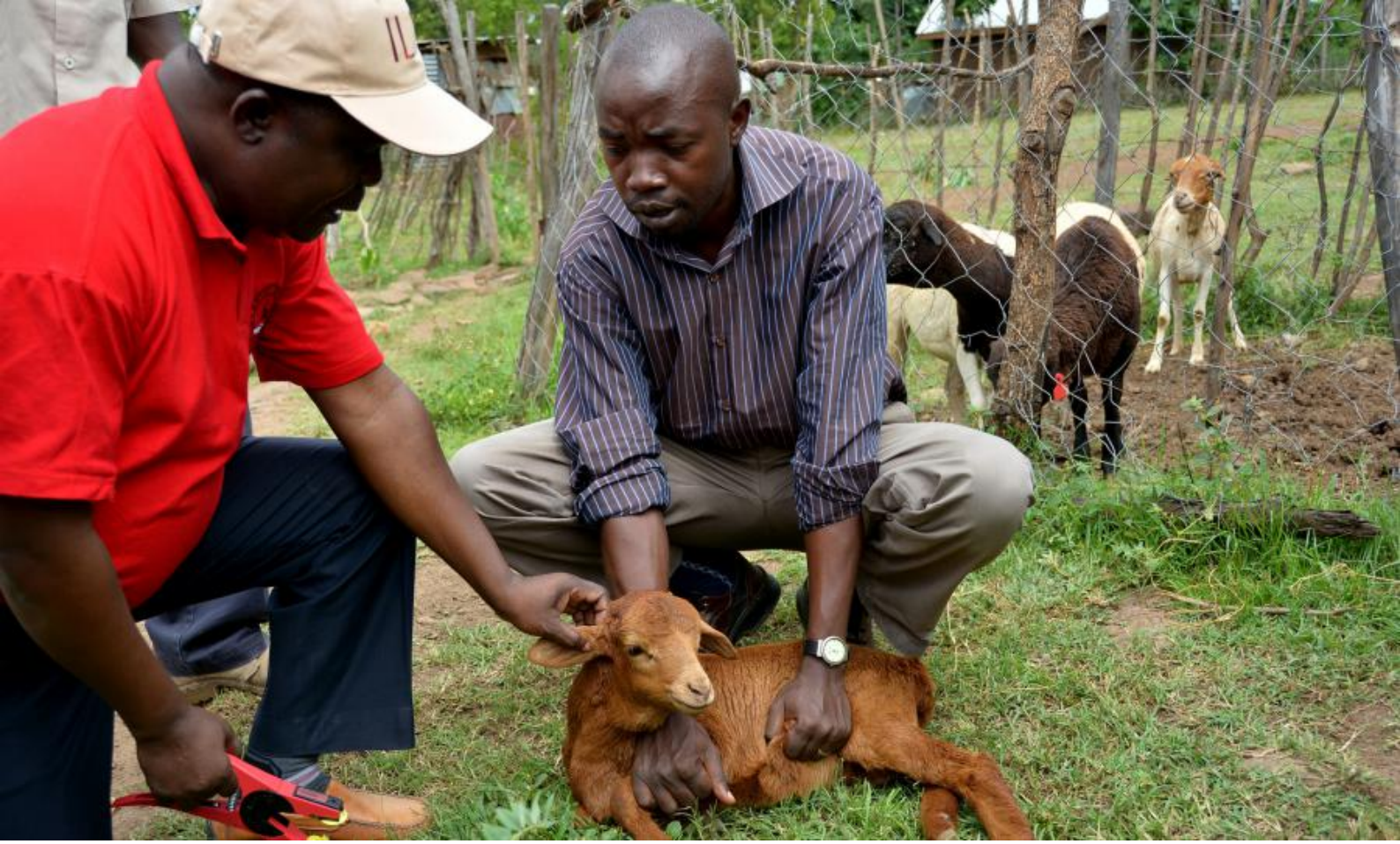

Photo: S. Kilungu (CCAFS)

BREAKTHROUGH SCIENCE AND INNOVATION

Breeding climate-smart 'super' goats

Goats and sheep (small ruminants) are important for household livelihoods in many parts of the world which must be considered in efforts for climate change adaptation. For this reason, starting in 2011, CCAFS and the International Livestock Research Institute (ILRI) have been working to help farmers in Kenya's Lower Nyando Basin develop new breeds of goats and sheep suited to conditions brought about by climate change – such as increasingly frequent droughts.

In 2015, the small ruminants project, led in partnership with Kenyan research organizations and government bodies, generated a high level of media interest. As a result, there were numerous visits to participating farms and interviews with lead scientists. A key highlight was the participation of the Deputy President of Kenya in the annual goat auction held at Barng'oror, Kapsorok in December

2015. During this auction, farmers purchased nearly 4 000 of the new climate-smart goats.

The goat breeding and rearing project is part of the wider Climate-Smart Villages initiative led by CCAFS. As such, villages in Nyando have been designated as test sites for climate-smart agriculture. The new goats bred by farmers in Nyando originate from selected Galla goats crossed with the local breed. The resulting cross-breeds have several advantages compared with the local breeds: they grow faster, they are resistant to internal parasites, and they tolerate drought and heat stress better. And, because they mature 6 months earlier than indigenous breeds, they have faster reproductive cycles and produce more milk and meat.

> "I now comfortably pay [school] fees for my children from the sale of the goats." **Daniel Langat, Nyando farmer**

The new 'super goats' have become so popular with local farmers that they are set to replace traditional breeds in Nyando completely in only a few years' time. The goats fetch 3 times the price of the indigenous breed, which shows how highly they are valued by farmers. And because so many farmers have switched to the new breed, the proportion of households enduring 2 'hungry months' each year – periods when they eat fewer than 2 meals a day – has fallen dramatically.

Read more

- NPR Blog: Heat tolerant, tough teeth, lots of milk – they're supergoats!
- Ojango JMK et al. 2015. Sustainable small ruminant breeding program for climate-smart villages in Kenya. CCAFS Working Paper No. 127

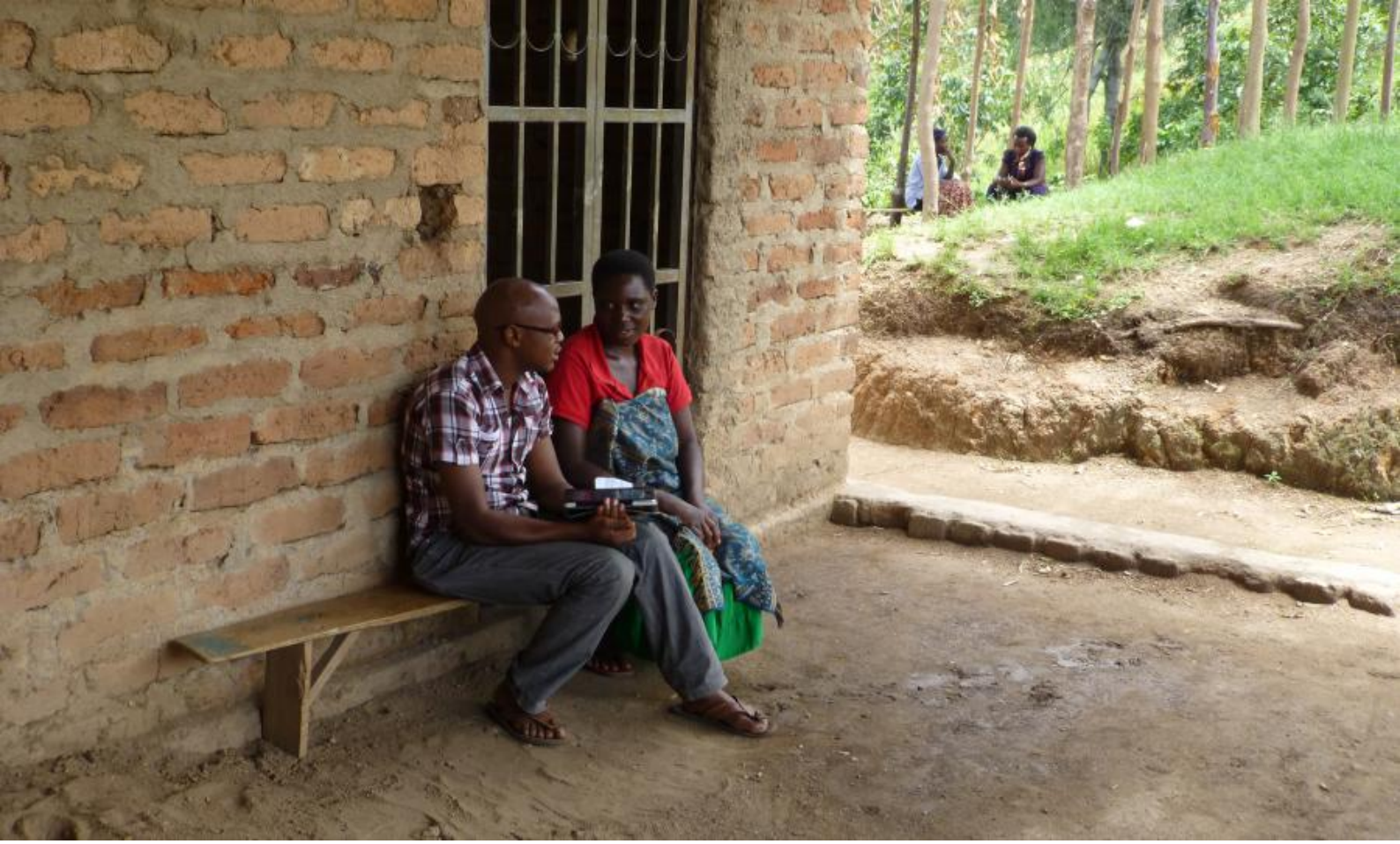

Photo: E. Lecoutere

INTEGRATING GENDER AND HARNESSING LOCAL KNOWLEDGE

More equal household decisions lead to more efficient smallholder farming

Decision making within farming households is not always equitable, leading to different outcomes for men and women. Gender programmes led by development workers can help address this, but how effective are they? Do they result in a real shift in power relations? And what is the impact on family livelihoods and the ability of these farmers to address the challenges of climate change?

Research carried out by CCAFS, the International Institute of Tropical Agriculture (IITA) and the University of Antwerp looked at the impact of a gender

programme led by the Hanns R. Neumann Stiftung (HRNS) foundation. The study compared the behaviour of participating couples with those not involved in the HRNS programme. The research team also compared their findings with those from individual survey data.

Researchers worked with the households of smallholder coffee farmers in western Uganda. They examined the investment and consumer behaviour of couples when both partners were involved in the household planning and decision making process – for example, in making decisions on what to grow and sell, and how to spend their profits from the farm.

The research found that joint decision making had a positive effect on investment in the couple's farm. This type of decision making appeared to contribute to farming systems that are better able to sustainably satisfy the cash and food needs of a household, leading to increased well-being and food security. The research also found that couples who engaged in shared decision making were more likely to have joint ownership of land for both cash crops and food crops, and joint control of profits. Overall, the outcome was more sustainable, efficient and equitable household farming systems that are better able to address the challenges of climate change.

> "Our household incomes and living conditions have improved. We have much more financial freedom and are now able to send our children to school." **Alex Asaba, smallholder farmer in western Uganda**

The Uganda research is part of a broader look at the impact of gender programmes on smallholder farmers. Further exploration includes addressing the likelihood that couples who voluntarily attend a course like those offered by HRNS are perhaps more open to joint decision making. Introducing the HRNS programmes randomly to smallholders is one approach by which changes in household investment and consumer behaviour could be attributed more confidently to the development intervention.

Read more

- Lecoutere E and Jassogne L. 2016. "We're in this together": changing intra-household decision making for more cooperative smallholder farming Institute of Development Policy and Management, University of Antwerp, Working Paper
- HRNS Blog: Improving gender relations in coffee farming households in Uganda

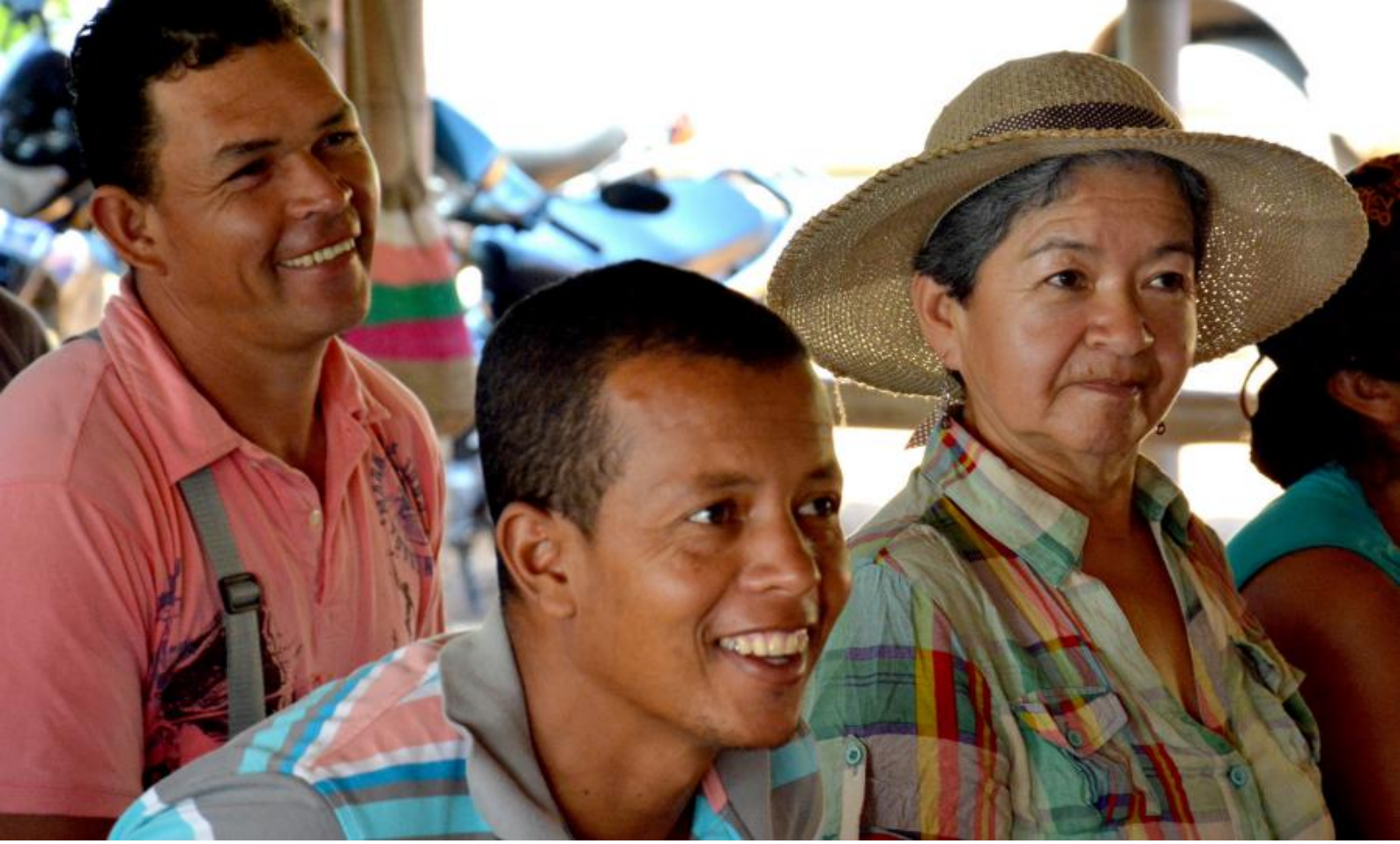

Photo: J. L. Urrea (CCAFS)

INTEGRATING GENDER AND HARNESSING LOCAL KNOWLEDGE

Women key to reducing emissions from cattle farming

Women play a crucial role in livestock production throughout Latin America. This means that any efforts to address climate change in the region's livestock sector must involve both men and women. To help governments incorporate gender perspectives into their policies and programmes, in 2015, CCAFS, the International Center for Tropical Agriculture (CIAT) and other partners analysed climate change mitigation opportunities for men and women livestock producers.

Summarized in a policy brief, the analysis focuses on silvopastoral systems that incorporate trees with pasture, thus mitigating the climate change impacts caused by methane gas released from ruminant livestock, such as cattle. It includes a series of policy recommendations for governments in Latin America.

Of these governments, those in Colombia and Costa Rica are working most closely with the partnership led by CCAFS and CIAT.

> "Both men and women in Latin American countries contribute significantly to beef and dairy value chains… However, women's work tends to be disregarded because it takes place simultaneously with home care and is usually non-paid." Gumucio T et al. 2015

The policy brief is part of a wider process to integrate gender perspectives into the activities and outcomes of the CIAT Livestock Plus programme. In particular, it is related to CCAFS and CIAT's work with government bodies in Colombia and Costa Rica to develop Nationally Appropriate Mitigation Actions (NAMAs) for the cattle sector.

Promoting silvopastoral systems is a strategic priority in Colombia's NAMA. And in Costa Rica, the government is promoting similar technologies such as 'living fences'. The CCAFS-CIAT brief aims to ensure that these NAMAs are based on a good understanding of both women's and men's roles in cattle production and are effective in mitigating greenhouse gas emissions and supporting sustainable development.

Read more

- Gumucio T et al. 2015. Silvopastoral systems in Latin America: Mitigation opportunities for men and women livestock producers. CCAFS Policy Brief
- CGIAR Blog: Entry points for change: mitigation opportunities for women and men livestock producers in Latin America
- Policy brief: Avances en la inclusión de intereses y necesidades de mujeres rurales en políticas públicas agropecuarias y de cambio climático: el caso de Colombia

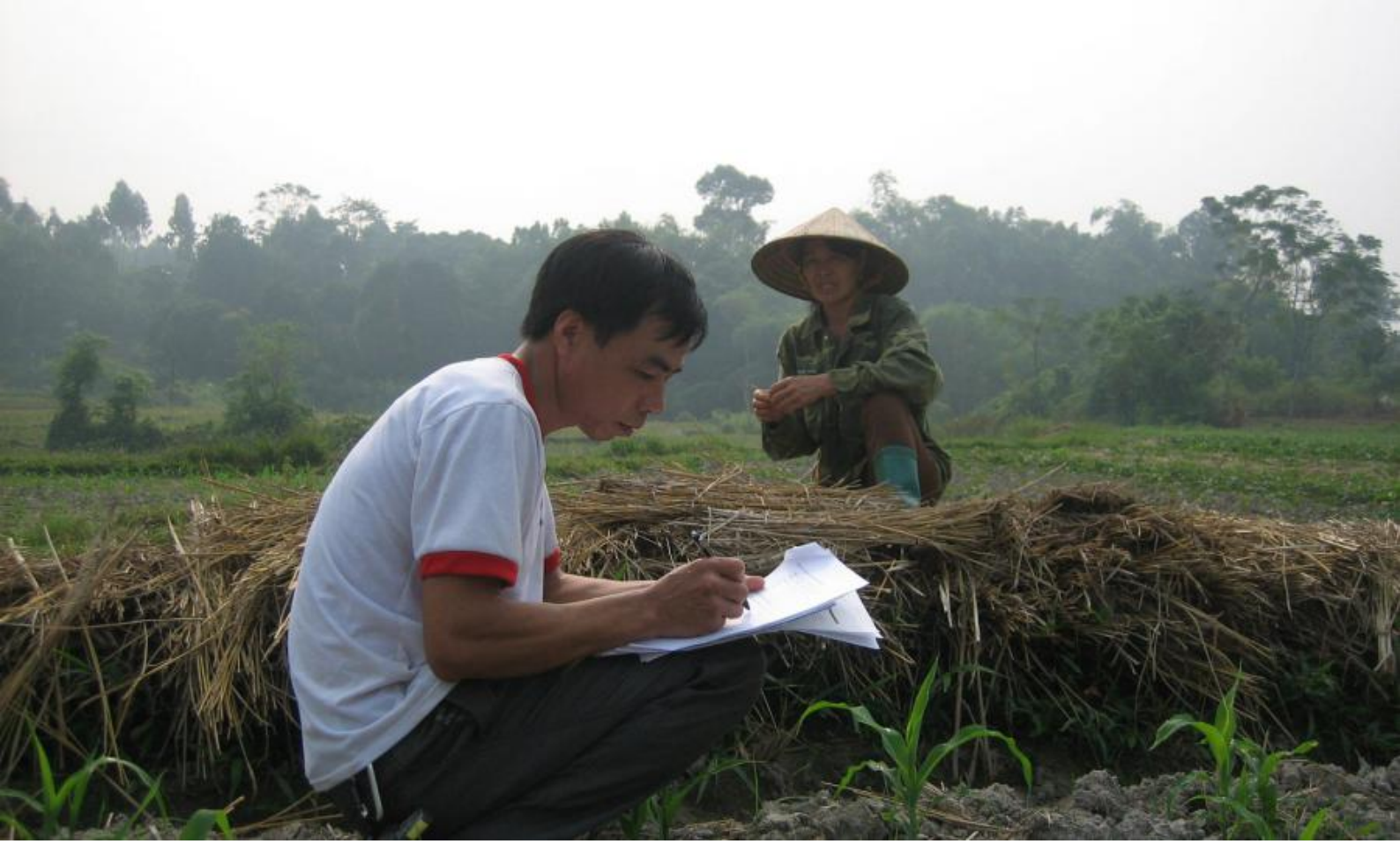

Photo: Nguyen Duy Nhiem (CIAT-Vietnam)

INTEGRATING GENDER AND HARNESSING LOCAL KNOWLEDGE

Sharing local knowledge to inform climate-resilient farming

In many parts of Asia, a lack of detailed geographic data is holding back the development and application of climate-resilient farming methods. Geographic information systems (GIS) can help fill these data gaps but do not take into account the local knowledge of smallholder farmers.

In contrast, participatory GIS (PGIS) enables farmers to share their knowledge with scientists, and combines this with methods to capture geo-spatial information – to create high-resolution maps that represent farmers' knowledge of the land and that can also be used to empower them.

A project led by CCAFS and the International Center for Tropical Agriculture (CIAT) is using PGIS to obtain local geographic information in northern Vietnam. In 2015, the team worked in the village of Ma in Yen Binh District with staff from the Northern Mountainous Agriculture and Forestry Institute, commune officials and 2 local farmers.

After a short training workshop, the team used GPS to map the fields of 100 households and, at each GPS point, used short, simple surveys to record information from farmers on issues such as crops and varieties grown, pests and diseases, and climate stresses. Ma Village is topographically complex, including forested mountains, low-lying paddy fields and several small cultivated islands. The team coped well with this challenge, however, completing their visit in just 3 weeks. The result? A detailed and extensive database with information on both the biophysical and socioeconomic aspects of the local farming system.

> "A successful survey requires fitting into farmers' busy schedule, visiting the fields when they are undertaking required activities, such as planting or weeding. As a GIS team, we need to be flexible and responsive to farmers' needs." **Huong Pham, agricultural economist at CIAT**

The PGIS project in Ma Village is part of the wider Climate-Smart Villages initiative led by CCAFS and partners, involving villages throughout Africa, Asia and Latin America as test sites for climate-smart agriculture. In Ma Village, the fine-grained data obtained via PGIS has several applications in this context; for instance, to spatially prioritize the best climate-smart agricultural practices and provide a baseline for monitoring their success. By turning farmers into field scientists, the programme has set itself up for promising results.

Read more

- CIAT Blog: Participatory GIS training launched in Vietnam

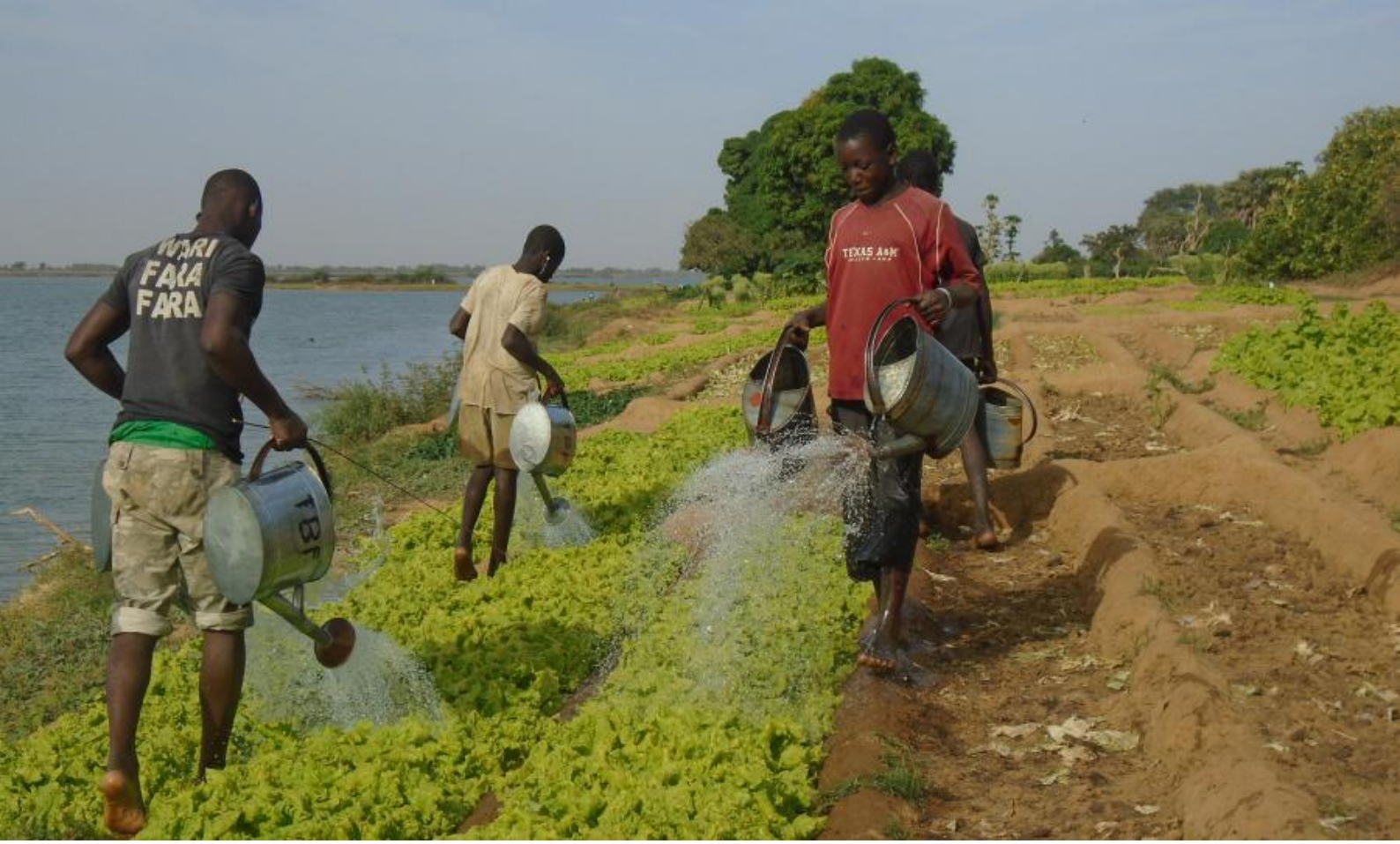

Photo:

INTEGRATING GENDER AND HARNESSING LOCAL KNOWLEDGE

West African farmers choose technologies for water storage

In many parts of sub-Saharan Africa, droughts are a continuous threat to smallholder farming. Today, about 25% of people in the region experience water stress, and increasing rainfall variability linked to climate change is set to make their livelihoods even more precarious. Small scale water storage can help farmers withstand dry spells – but which of the many available methods should farmers choose?

Over the course of 3 months in 2015, researchers from the International Water Management Institute (IWMI) and the International Livestock Research Institute (ILRI) explored this question with 6 communities in Burkina Faso's Yatenga Province, and conducted a household survey in Mali. These activities were part of a wider project, building climate-smart farming systems through integrated

water storage and crop–livestock interventions.

The research team used a household survey to identify which water storage methods local farmers were already using. They followed this by asking groups of local people to evaluate and rank a range of water storage technologies, including some which were new to them. Various criteria were considered, including: feasibility, food security, effectiveness for climate adaptation and effectiveness for climate mitigation. During lively discussions, farmers showed an excellent understanding of climate-smart agriculture and made their requirements very clear.

The research identified several promising water storage technologies for villagers to test. These included micro-pits and semi-circular bunds, harvesting water from roofs, shallow wells, solar pumps and drip irrigation. Researchers were gratified by the large number of farmers who volunteered to help try out these methods.

Given the trends of population growth and increasing rainfall variability throughout sub-Saharan Africa, the role of water storage in securing livelihoods in the region cannot be overstated. Improving water storage will increase agricultural resilience and make it possible for farmers to produce crops throughout the year. Ultimately, it should mean reduced poverty and better food security for farming households.

CCAFS People

The success of the CCAFS program depends on the efforts and dedication of its people. The following staff and scientists were active in 2015.

Independent Science Panel (ISP)

- Bruce Campbell, ex officio, CCAFS Program Director, International Center for Tropical Agriculture (CIAT) (Colombia)
- Fatima Denton, African Climate Policy Centre (ACPC) and the United Nations Economic Commission for Africa (UNECA)
- Arona Diedhiou, Institute of Research for Development (IRD), Joseph Fourier University of Grenoble (France)
- Brian Keating, Chair, CSIRO Sustainable Agriculture Flagship (Australia)
- Ruvimbo Mabeza-Chimedza, Department of Agricultural Economics and Extension (Zimbabwe)
- Charles W. Rice, University Distinguished Professor, Kansas State University (USA)
- Ram Badan Singh, National Academy of Agricultural Sciences (India)
- Carolina Vera, Center for Atmosphere and Ocean Sciences (CIMA) and Instituto Franco-Argentino sobre Estudios de Clima y sus Impactos (UMI/IFAECI) (Argentina)
- Christof Walter, Vice-Chair, Christof Walter Consulting Ltd (UK)

Program Management Committee

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- Bruce Campbell, ex officio, Program Director, International Center for Tropical Agriculture (CIAT) (Colombia)
- Andrew Jarvis, Theme Leader (Long-term Adaptation), International Center for Tropical Agriculture (CIAT) (Colombia)
- Sonja Vermeulen, Head of Research, University of Copenhagen (Denmark)
- Eva 'Lini' Wollenberg, Theme Leader (Low Emissions Agriculture), University of Vermont (USA)
- Robert Zougmoré, Regional Program Leader, International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)

CGIAR institutional contact points

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- Center for International Forestry Research (CIFOR), Mariana Rufino and Louis Verchot
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- International Water Management Institute (IWMI), Vladimir Smakhtin
- World Agroforestry Centre (ICRAF), Henry Neufeldt
- WorldFish Center, Suan Pheng Kam and Sarah Park

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- Vanessa Meadu, Communications and Knowledge Manager (Denmark)
- Angela Samundengo and Julian Rivera, Manager, Finance, Contracts and Liaison, International Center for Tropical Agriculture (CIAT) (Colombia)
- Ratih Septivita, Events and Program Support Coordinator (Indonesia)
- Sonja Vermeulen, Head of Research, University of Copenhagen (Denmark)

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- Andrew Challinor, Climate-Smart Agricultural Practices, University of Leeds (UK)
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- Sekou Fadiala Touré, West Africa, International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) (Mali)
- José Luis Urrea Benitez, Latin America, International Center for Tropical Agriculture (CIAT) (Colombia)
- Julianna White, Low Emissions Agricultural Development, University of Vermont (USA)

Financials

Financial results for 2015

In 2015, the total CCAFS budget was USD 66.064 million composed of: CGIAR Window 1 and 2 (W1&2) 2015 funds of USD 33.720 million as per final revised Financing Plan; USD 32,101 of Bilateral & Window 3 (W3) sources from all CGIAR Participating Centers; and by a CGIAR W1&2 carry-over of USD 0.472 million (later cut by USD 0.230 million). Total execution was USD 58.3 million (88.2%). Gender and social Inclusion research activities were USD 7.134 million, approximately 12.2% of the total annual execution. Total W1&2 2015 funds were paid in two tranches, 35% (USD 11.873 million) in July and 65% (USD 21.847 million) by end of November. 28% of these funds were W2 (USD 9.405 million) and 72% W1 (USD 24.315 million). The W1&2 budget cuts – 32% in relation to initial POWB – made implementation difficult, posing the only real challenge to CCAFS in 2015.

Table 1 shows the budget and expenditures by natural classification and Table 2 by Unit, differentiating Participating Centers from Core Team Units such as Flagship Leaders, Regional Program Leaders and Coordinating Unit.

Table 1: Execution as of 31 December 2015 per natural classification and funding source In thousands of USD

Budget Categories	Budget	Expenditures	Execution %
Personnel	16,934	17,829	105%
Collaborators Costs - CGIAR Centers	475	1,103	232%
Collaborator Costs - Partners	20,595	15,307	74%
Supplies and services	15,120	12,526	83%
Operational Travel	3,872	3,462	89%
Depreciation	159	305	192%
Contingency	64	17	
Subtotal	57,218	50,547	88%
Indirect Costs	8,846	7,702	87%
Total - All Costs	66,064	58,250	88%

Table 2: Execution as of 31 December 2015 per Unit In thousands of USD

Unit	Budget	Expenditures	Execution %
AFRICARICE	61	19	31%
BIOVERSITY	6,343	6,145	97%
CIAT CENTER	12,883	9,931	77%
CIFOR	995	909	91%
CIMMYT	3,976	5,426	136%
CIP	567	742	131%
ICARDA	24	28	118%
ICRAF	4,630	5,033	109%
ICRISAT	3,603	2,782	77%
IFPRI	2,603	2,600	100%

Unit	Budget	Expenditures	Execution %
IITA	1,653	2,072	125%
ILRI	2,860	2,732	96%
IRRI	1,715	1,618	94%
IWMI	1,487	1,535	103%
IRI-Columbia University	221	187	85%
WORLDFISH	993	1,017	102%
Total Participating Centers	44,614	42,778	96%
FP1 Leader (CIAT & Leeds U.)	1,173	1,123	96%
FP2 Leader (CIAT & Columbia U.)	4,096	1,320	32%
FP3 Leader (CIAT & Vermont U.)	3,139	1,241	40%
FP4 Leader (CIAT & ILRI)	1,172	1,212	103%
Total Flagship Leaders	9,581	4,896	51%
RPL Latin America (CIAT)	1,204	1,020	85%
RPL East Africa (ILRI)	1,180	1,498	127%
RPL West Africa (ICRISAT)	1,246	1,270	102%
RPL South Asia (CIMMYT & IWMI)	1,944	1,110	57%
RPL Southeast Asia (CIAT & IRRI)	1,081	1,057	98%
Total Regional Program Leaders	6,654	5,955	89%
Copenhagen University	1,608	1,418	88%
Gender and Social Inclusion Leader (CIAT)	578	336	58%
Total Cross-cutting research and engagement	2,186	1,753	80%
Global Engagement and Management (CIAT & ILRI)	3,028	2,868	95%
Total	66,064	58,250	88%

Financial outlook

Given the decrease of W1W2 budget for CCAFS in 2015 and 2016 compared to previous years, there has been a setback in the funding of several CCAFS projects for the end of Phase I.

The estimated total budget of year 2016 is USD 47,349 million, 50% from W1W2 funds and 50% from W3 & Bilateral grants.

Funding and strategic partners

Funders

The Program gratefully acknowledges the support of its funders

- CGIAR Fund Donors
- Australia (ACIAR)
- Ireland (Irish Aid)
- Netherlands (Ministry of Foreign Affairs)
- New Zealand
- Switzerland (SDC)
- Thailand (through the Department of Agriculture
- The UK Government (UK Aid)
- USA (USAID)
- The European Union (EU)

The Program is carried out with technical support from

The International Fund for Agricultural Development (IFAD)

Partners

The CCAFS program is a strategic partnership of CGIAR and Future Earth, led by the International Center for Tropical Agriculture (CIAT)

CCAFS is a collaboration among all 15 CGIAR research centers and work is led by staff at CGIAR centres and at five partner universities

- Leeds University - School of Earth and Environment
- Columbia University - International Research Institute for Climate and Society
- University of Vermont - Gund Institute for Ecological Economics
- University of Oxford - Environmental Change Institute
- University of Copenhagen - Faculty of Science

Read more about our key partners and partnerships approach.

CCAFS is led by
the International Center for Tropical Agriculture (CIAT)
in collaboration with
all CGIAR Centers:

AfricaRice
Bioversity International
CIFOR
ICARDA
CIAT
International Center for Tropical Agriculture
Since 1967 / Science to cultivate change
ICRISAT
Science with a human face
IFPRI
IITA
Research to Nourish Africa
ILRI
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CIMMYT
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CENTRO INTERNACIONAL DE LA PAPA
CIP
IRRI
IWMI
International Water Management Institute
World Agroforestry Centre
TRANSFORMING LIVES AND LANDSCAPES
WorldFish

CCAFS gratefully acknowledges support from its funders:

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Australian Centre for International Agricultural Research

Irish Aid
Government of Ireland
Rialtas na hÉireann
Ireland's commitment to a world without poverty and hunger

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Swiss Agency for Development and Cooperation SDC

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