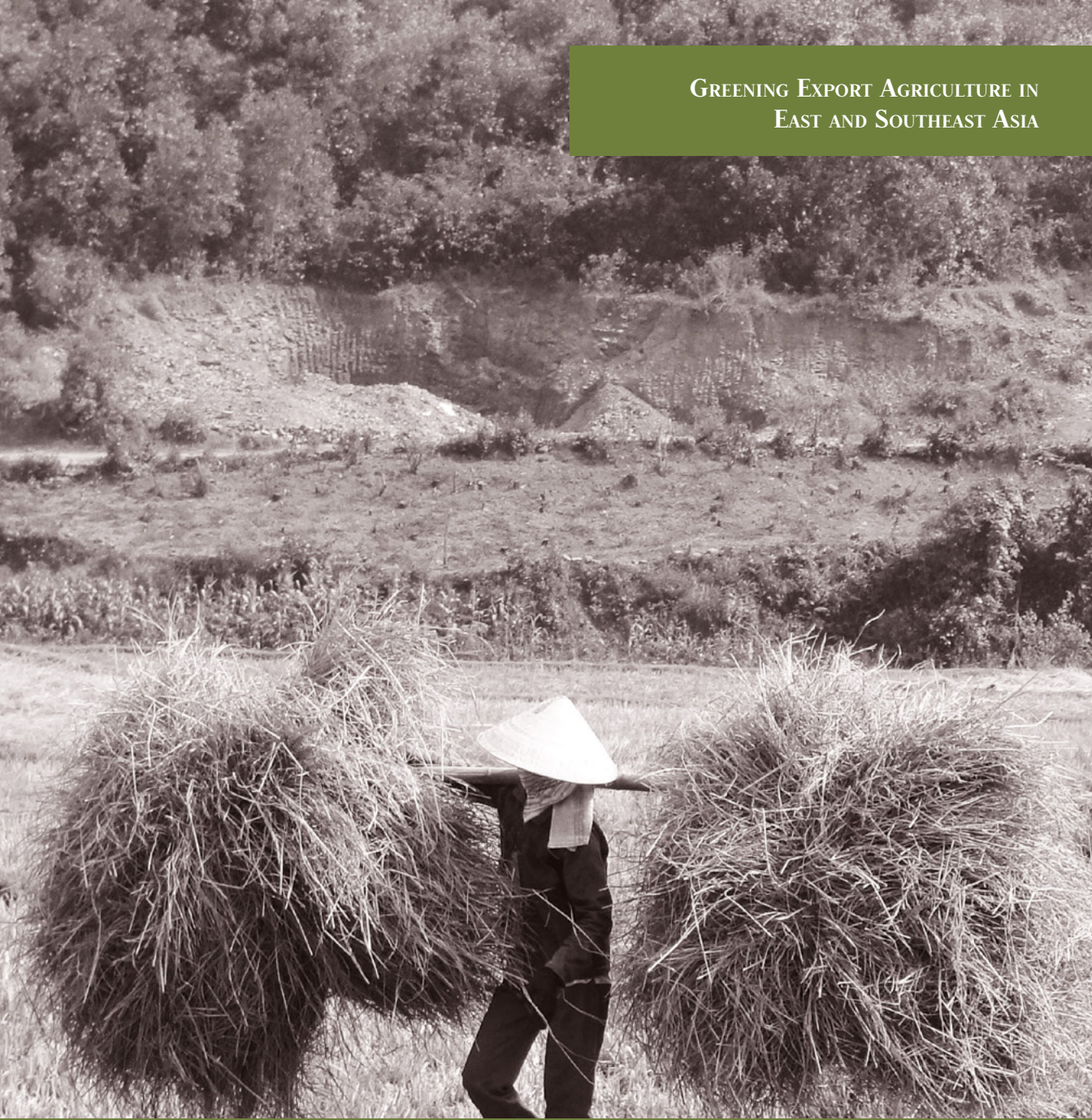




GREENING EXPORT AGRICULTURE IN
EAST AND SOUTHEAST ASIA

SHADES OF GREEN

**MULTI-STAKEHOLDER INITIATIVES TO REDUCE THE
ENVIRONMENTAL FOOTPRINT OF COMMERCIAL AGRICULTURE**

Edited by Mirvat Sewadeh & Steven Jaffee



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INTRODUCTION

1

Steven Jaffee and Mirvat Sewadeh

While contributing to economic and income growth, commercial agriculture has sometimes contributed to the degradation of ecosystem services, including deforestation and greenhouse gas emissions, biodiversity loss and wetlands destruction, and surface water pollution and depletion of aquifers. These impacts are not inevitable and there are a wide range of instruments which can and are being used to reduce agriculture's environmental footprint (and benefit from the perception of eco-friendliness in consumer markets). These include various regulatory, financial, and advocacy mechanisms employed by governments and/or non-state actors to induce or facilitate more eco-friendly agricultural practices.¹ Development agencies and nongovernmental organizations have gotten involved in many 'green agriculture' initiatives, with some focusing on specific commodity production systems.

This compendium of short case studies highlights interesting experiences and lessons learned from an array of initiatives aimed at reducing commercial agriculture's environmental footprint. Some of these are drawn from developing countries, with many of the focal initiatives also seeking to strengthen community development and rural livelihoods. Other cases are drawn from several OECD countries and tend to have a combined emphasis

on conservation and agricultural competitiveness. Particular attention is given to the lessons learned from—or for—government actions to prevent, reverse, or otherwise address adverse environmental impacts from commercial agriculture. Many of the cases have featured both public and private roles, yet the authors have sought to highlight important lessons for public policy.² Our primary interest lies in highlighting innovative institutional arrangements rather than documenting technological solutions.³

The case studies in this compendium were identified through a 'crowd-sourcing' process in which the World Bank team issued a Call for Abstracts and circulated this through an array of development partner, research, and sustainable agriculture networks. Between December 2013

2 There is a growing literature dealing with the application and efficacy of pure private sector initiatives, especially 'voluntary' environmental standards related to specific commodities and their production. This compendium does not include cases of that nature. It also does not include cases that essentially conclude that the pertinent role of government is to get out of the way. Such a finding may well be pertinent in a specific setting but this is not a generalizable conclusion.

3 That is, approaches to provide rights, controls, incentives, penalties, and strengthen capacities. Where important technological advances have made a contribution, our interest is more in the modalities/incentives to induce adoption of such technologies rather than in the specific intricacies of the latter. Readers interested in understanding a wide array of 'green agriculture' technologies should consult "Where the land is greener: case studies and analysis of soil and water conservation initiatives worldwide" put together by the consortium of entities involved in the World Overview of Conservation Approaches and Technologies.

1 See Mankad, K. S. Jaffee, S. Scherr and C. Negra. 2014. Policy Instruments to Reduce the Environmental Footprint of Commodity Agriculture: Lessons from East and Southeast Asia. *From Aspiration to Application: Policies for Greening Agriculture in East and Southeast Asia*. Washington, DC: EcoAgriculture Partners.

Table 1. Summary of the foci of each case study.

Country	Sub-Sector	Main Features/Focus	Roles of Government
Ireland	Livestock	Quality assurance/ environmental monitoring	Funder, promoter
Uruguay	Livestock/Crops	Soil management plans	Regulator, enabler
USA	Fruit/Vegetables/ Nuts	Integrated pest management	Funder, promoter
USA	Dairy	Environmental management	Funder, promoter
Italy	Fruit	Soil and water management	Regulator, funder
India	Cereal crops	Groundwater management	Regulator, promoter, funder, enabler
USA	Field crops	Pollution reduction	Enabler
India	Mixed crops	Community-based natural resource management	Enabler, funder
Indonesia	Aquaculture	Mangrove protection	Regulator
Cambodia	Rice	Sustainable rice intensification	Enabler
D.R. Congo	Cocoa	Landscape management	Definer, funder, promoter
Cambodia	Rice	Wildlife protection	Regulator, enabler
Tanzania	Tea	Pest and soil management	Enabler

and February 2014, thirty proposals were submitted. These were screened for consistency with the aims and themes of the planned compendium and selections were also made with a goal of featuring a very diverse set of cases in terms of geography, targeted types of farmers, prevailing environmental challenges, and the types of measures taken to address these. Case study authors were provided with a common template and set of analytical questions. They were asked to keep the description of the scheme short and to emphasize points of analysis and lessons learned.⁴

This compendium is intended for two sets of audiences. One consists of policy

makers, their advisors, and other officials in developing countries dealing with matters related to the environmental risks of (or potential ecosystem services from) commercial agriculture. The second consists of development organizations and practitioners who are involved in initiatives aimed at supporting sustainable agricultural practices.

The compendium consists of thirteen case studies. The order in which they appear relates, more or less, to the locus of intervention. A few initiatives have had a national coverage, yet often with a focus on some lead commodity sub-sectors. Several of the cases relate to reducing the environmental footprint of livestock sub-sectors on a very broad scale. Other case studies relate to programs and policies centered on mixed agriculture at the

⁴ This crowd-sourcing process was led by Mirvat Sewadeh, at the time a consultant to the World Bank. The Call for Abstracts was circulated by field-based World Bank staff as well as numerous development partners.

provincial or state levels. The third set of case studies highlight examples of natural resource management at the community level. The final set of case studies pertains to efforts to promote certified sustainable production of particular commodities in vulnerable landscapes.

The cases bring out a diversity of (potential) roles for national or local government agencies, including ones related to regulation, advocacy/education, technology research and development, information or technology dissemination, and financing. As a regulator, the government would establish and enforce the rules of the game for sustainable agriculture. Regulations can take multiples forms—relating to land use and tenure, sale and use of certain production inputs, environmental damage liability, etc. As an enabler, the government would encourage and facilitate processes of voluntary action, through a mix of information and incentives. As a funder, government may provide direct or indirect financing for investments, technology adoption, to reduce the costs of collective action, etc. Finally, as a promoter, the government mobilizes public support for the vision and implementation of private and civil society actions and investments to achieve sustainable production and green outcomes. A quick summary of the foci of the case studies is provided in Table 1.

The diversity of the cases poses a challenge for identifying common patterns and lessons. That being said, many of the cases:

- Point to the challenge of sustainable financing for agricultural sustainability initiatives. Market premiums for (certified) sustainable produce rarely provide sufficient margins to fund complex technical and institutional programs. Public resources were generally important even in programs where the private sector plays a major if not leading role;
- Highlight the major importance of having accurate and timely land use and

environmental data and information on farmer practices. Compiling and managing this information at scale seems to require effective use of information and communications technologies;

- Illustrate that progress in the ‘greening’ of agriculture typically occurs through incremental steps and gradual program roll-outs rather than through grand solutions initiated at scale. There are many reasons for this, including (a) the preference of most farmers to be ‘second movers’ making observations and drawing lessons from early adopters, (b) the common situation where some new practices are relatively easy and low cost while others are more challenging (or the business case for adoption is less evident), and (c) the need to build up trust and close coordination among multiple stakeholders and agencies;
- Point to the value of explicit learning platforms—rather than ad hoc consultations—for refining programs and improving their effectiveness and outreach over time; and
- Suggest that different levels of government often play distinctive roles in successful initiatives. While national government entities normally serve as regulators, funders and providers of scientific information, local government entities need to apply ‘soft skills’ in helping to promote green agriculture initiatives, in mobilizing and supporting people for collective action, and in finding ways to adapt or interpret broader regulations to fit local circumstances.

ORIGIN GREEN: DRIVING THE SUSTAINABILITY OF THE IRISH FOOD AND DRINK SECTOR

Padraig Brennan and Jim O'Toole

2

SUMMARY

Origin Green is a national sustainability program developed in Ireland by Bord Bia—the Irish Food Board. It offers an independently verified structure for Irish farmers and food manufacturers to demonstrate their sustainability performance and develop plans for further improvements. The target for the program is to have 75 percent of food and drink exports coming from farms and food manufacturers that are members of Origin Green by the end of 2014.

BACKGROUND

Ireland has around 140,000 farm holdings with an average size of 32 hectares. Some 110,000 farms have cattle. The average herd size stands at 60 cattle. Herd size can vary widely, with the average herd size in the western part of the country around half of that in the eastern part.

The [Origin Green](#) sustainability program, launched in June 2012, has been developed by Bord Bia—the Irish Food Board, a semi-state organization under the auspices of the Irish Department of Agriculture, Food and the Marine. Bord Bia's remit is the promotion of Irish food and the implementation of quality assurance programs for all agricultural sectors, spanning livestock, poultry, dairy, eggs, and horticulture.

The food and drink sector is a key driver of the Irish economy, accounting for more than two-thirds of indigenous manufacturing and 11 percent of total exports, and it employs more than 250,000 people. The sector is highly export oriented, with more than 85 percent of all its beef

Location

Ireland

Timeline

2011 to present

Land Use

livestock

Partners

Department of Agriculture, Food and the Marine, Teagasc

Role of Government

funder, promoter

and dairy production exported annually. In 2013, the value of food and drink exports approached US\$12.5 billion for the first time, with recorded trade to more than 180 countries across the globe.

EVOLUTION OF THE INITIATIVE

The Irish food and drink sector has strong growth ambitions. An industry strategy, [Food Harvest 2020](#), developed by the Department of Agriculture, Food and the Marine with the active involvement of all stakeholders, has set a target for exports to reach US\$15 billion by 2020. The initiatives required to achieve these targets were developed under three themes: Smart, Green, and Growth. Under the Green theme, the need to credibly demonstrate credentials and drive further improvement was the key driver identified.

A critical component to delivering on this export target is the reputation of the Irish food and drink sector in the marketplace as

a supplier of safe, high quality, and responsibly produced products. In recent years, Bord Bia has witnessed an ever-increasing focus on sustainability issues among leading retailers and food manufacturers. As a supplier to many of them, the Irish food and drink industry recognized the need to be able to demonstrate its sustainability credentials and its commitment to further improving performance over time.

This was the key catalyst behind the development of Origin Green. Following ongoing discussions with leading customers and stakeholders within the sector, Bord Bia set about developing a program that would offer an independently verified structure for both farm and food manufacturing. Achieving the sector's export targets requires access to more high-value customers on a consistent basis. One of the key areas of focus for such customers is sustainability. Irish farmers recognize that this is an area of strength for Irish agriculture, and they want to be able to credibly demonstrate this. They view Origin Green as providing the vehicle to communicate this.

Bord Bia has worked closely with a number of organizations in both Ireland and further afield on different elements of Origin Green. These include: Teagasc (the national agricultural research and farm advisory organization), The Carbon Trust, the Department of Agriculture, Food and the Marine, the Irish Cattle Breeding Federation, and the Environmental Protection Agency. One of the key criteria for Bord Bia from the outset was the need for any farm assessments to be credible. Working closely with Teagasc and The Carbon Trust, Bord Bia developed a PAS 2050-accredited carbon footprint calculation model for cattle farms in 2011.

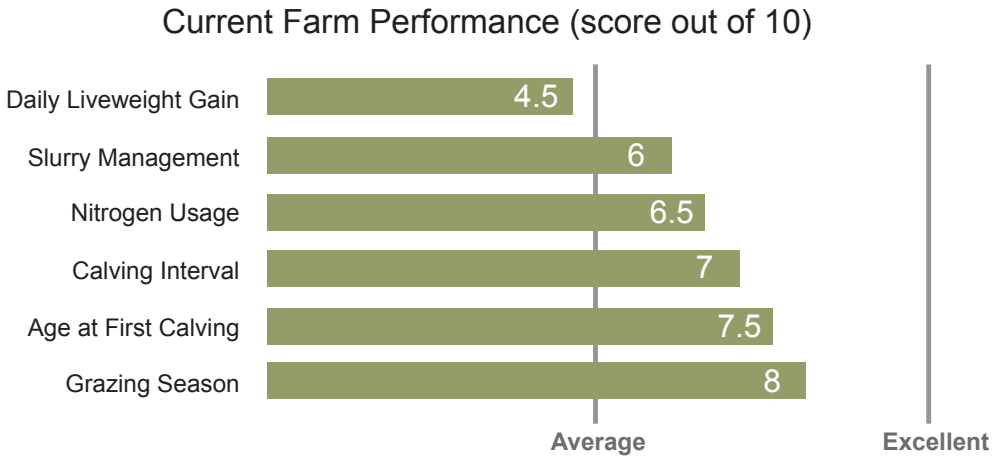
The initial pilot phase of application found how levels of variation in cattle farm performance, with the best performing farm having a footprint of less than

half that of the weakest. This led Bord Bia to extend assessments to all 40,000 farms that are part of its Beef Quality Assurance Scheme. This needed to be done in a cost-effective and efficient manner in order to be feasible. Rolling out the program required two things: (1) the 'farmers' permission to access information on their farm held by other agencies and (2) collaboration with these organizations to establish an efficient manner to share information. The rollout of the beef program has been funded by the Department of Agriculture, Food and the Marine as part of Bord Bia's Beef Quality Assurance Scheme.

Virtually all farmers agreed to allow Bord Bia access to data on their farm held by the Department of Agriculture, Food and the Marine and the Irish Cattle Breeding Federation. Both of these organizations hold detailed livestock information, which is critical to assessing their footprint. Farmers were asked to take part via regular contact with them through the Quality Assurance network, discussions with farmer organizations, and a communications program via national farming media. The remaining information is collected on-farm using handheld technology by Bord Bia as part of the regular farm audits. All of this information is stored in real time in Bord Bia's database, which automatically calculates an indicative carbon footprint for each farm. To date, more than 55,000 assessments have been completed.¹

A key dimension of the program is feedback and advice. The initial feedback focuses on informing farmers on how they are performing and how the results compare with those of other similar farms. This feedback also highlights farm performance in relation to grazing season length, productivity of the cow herd, animal performance, fertilizer usage, animal feeds, and manure management. This feedback

¹ The Ministry's Animal Identification Movement provides a full profile of each animal in each herd.



Increasing your farm performance by 10 percent could boost your farm's financial performance by US\$4,400 and reduce greenhouse gas emissions from your beef enterprise by 5 percent.

Figure 1. Sample of feedback provided to farmers

focuses on the potential impact in terms of both environmental and economic performance from improving in these areas.

Bord Bia and Teagasc have worked together to develop Carbon Navigator tools. By working with their advisers, farmers can set targets for improvement in practical management areas and see the potential impact of achieving them in their farm's footprint and financial performance. These tools are also made available through the Teagasc discussion group network. The core message of the feedback and advice program is that sustainable and efficient production go hand in hand.

The range of measures incorporated as part of the sustainability assessment on beef farms has been extended to include water and biodiversity measures, which are in addition to existing animal health/welfare, traceability, and soil management.

At the food manufacturing level, companies can become a [verified member](#) of Origin Green by developing a multi-annual sustainability plan with clear targets across three key areas: raw material sourcing, resource efficiency, and social sustainability. Companies also commit to submitting a progress report annually to outline their

performance toward reaching their targets. Both the plan and progress reports are verified by an independent third party. Bord Bia offers companies one-to-one support during the plan development phase. However, in order to make all of the relevant expertise available to companies, Bord Bia has collaborated closely with a resource efficiency program called Green Business, which is funded by the Environmental Protection Agency. [Green Business](#) offers companies a free resource efficiency assessment and recommends areas for potential savings. The average savings identified to date stands at US\$75,000 annually.

ANALYSIS AND LESSONS LEARNED

The approach taken by Bord Bia with Origin Green is unique in that it involves a complete sector at a national level. One of the most satisfying aspects of the program has been the level of engagement achieved at both the farm and food manufacturing level. This is demonstrated by the [progress made](#) since the program's launch in the second half of 2012. The role played by the government was also innovative in that, through the development of the Food Harvest 2020 blueprint, it was able to secure

buy-in from all stakeholders and deliver a joined-up approach to delivering on the targets outlined.

Moreover, the approach was innovative in that it realized the potential of a program such as Origin Green to not only show how the Irish agri-food sector is addressing the challenges presented by climate change but also provide a framework to communicate the program to key customers. By doing this, it allows Irish exporters to show key customers what they are doing, demonstrate how they can help them reach some of their sustainability targets, and build stronger business relationships with them.

At the farm level, almost 90 percent of the beef produced in Ireland comes from farms that are part of the Sustainability program. Over the next 18 months, all dairy farmers will be covered by a similar program, with all primary agricultural sectors having similar programs in place by the end of 2014. At the food manufacturing level, 320 companies have registered to take part in Origin Green. As of March 2014, some 45 of these have become fully verified members of Origin Green and a further 55 have submitted plans.

Verified members account for almost 60 percent of food and drink exports. The program has set a target of having 75 percent of exports covered by verified members by the end of 2014.

A number of elements have been critical to the success of the program to date:

- The presence of a government strategy for the [agri-food sector](#) in Ireland that incorporated the ambition to focus on enhancing its sustainability performance, at both the farm and company levels. This was instrumental in securing the buy-in of all key stakeholders from the outset;
- The ability of Bord Bia and agencies that it has worked with such as Teagasc and the Environmental Protection

Agency to clearly show that the potential benefits for all involved in terms of financial savings, efficiency gains, and potential marketplace benefit made it easier to secure buy-in from farmers and companies alike;

- Bord Bia's ability to coordinate expertise from all relevant state agencies such as Teagasc, the Environmental Protection Agency, and the Department of Agriculture to ensure that all relevant expertise was harnessed. This has resulted in a common focus for all involved;
- The fact that Bord Bia already had an auditing infrastructure in place through its Quality program helped to significantly streamline the process of engaging with farmers;
- The program works on the basis of using existing relevant information that is held by various agencies to help reduce the amount of data that needs to be captured directly from farmers. This boosts the efficiency of the program and helps provide a detailed profile of each farm; and
- In addition, regular communication through workshops, one-to-one meetings, and the buy-in of farming organizations has helped to embed the concept of Origin Green. A similar approach has been applied at the company level.

The initiative also faces numerous challenges. For example:

- Building a tangible business case and delivering a farm-level program at the scale required while securing ongoing engagement is an ongoing challenge;
- Although farmers and food manufacturers are focused on producing in a responsible manner, they also need to receive some tangible benefits from investing time and resources to manage their sustainability performance. This presented a key challenge to securing initial buy-in. This was overcome by

using a small number of pilot participants and communicating their results to show the potential benefits offered by improving environmental performance;

- Another challenge was how to build a program that could deliver industry-wide scope. At the farm level, this was overcome by using the Quality Assurance Scheme infrastructure, which sees Bord Bia inspecting almost 30,000 farms annually; and
- Maintaining momentum once initial ‘curiosity’ passed was not easy. To overcome this, the program focused strongly on using practical language in communications with farmers and food manufacturers.

All of these elements have the potential to provide valuable lessons to countries/sectors that are interested in developing similar programs. Based on experiences to date, the following advice is offered to those considering a similar program.

- Use all the expertise that is available to you and agree on the long-term objectives of the program from the start.
- It takes time to get a structure in place that can start delivering on your objective. With this in mind, you need to be realistic in terms of timelines and objectives.
- Don’t wait until everything is perfect. It’s better to make a solid start and let the program evolve as you gain experience with what works and what doesn’t.
- A key focus of any program needs to be securing and maintaining farmer and company engagement. To achieve this, these stakeholders need to believe in the program objectives.
- Communication is critical—in terms of both Bord Bia communicating the benefits and participants having a way of communicating feedback that can help improve the program.

It is believed that the approach taken with Origin Green has the potential to be adapted elsewhere regardless of prevailing circumstances because all it requires is a genuine commitment from all involved. Once this is present, all other elements of the program can be adapted to reflect any local limitations that may be evident. Although it is still relatively early in the implementation of Origin Green, experience to date at both the farm and food manufacturing level clearly shows that Origin Green can deliver enhanced resource and business efficiency within the sector while protecting the natural environment, maintaining an economically viable sector, and playing its part in helping to address the global sustainability challenge.

INFORMATION SYSTEMS FOR SUSTAINABLE AGRICULTURE, URUGUAY

Katie Kennedy Freeman and Raquel Orejas

3

SUMMARY

The Sustainable Management of Natural Resources and Climate Change (DACC) project in Uruguay is driving innovation in the climate-smart agricultural agenda in the country. With a long term vision to promote sustainable intensification, the Ministry of Livestock, Agriculture, and Fisheries is encouraging better planning and more intensive data collection for more informed decision making at the policy and household levels. The DACC project is supporting these objectives through a number of initiatives targeting small farmers to reduce risks and increase production, notably the establishment of an Agricultural Information and Decision Support System (SNIA) and the required preparation of soil management plans.

Across the world, more information about climate, soil, and crop production is making decision making processes more robust and flexible. In Uruguay, better information is helping improve production and expanding markets. Uruguay, famous for its cattle traceability, is now introducing agricultural traceability.

BACKGROUND

The Uruguayan agricultural sector will continue to be one of the major economic drivers of the country. The sector, which includes crops, livestock, and forestry, is one of the major contributors to GDP and employment. The crop subsector has increased its relative importance, growing in weight from 22 percent of GDP in 2001 to 32 percent in 2011. Since the 1960s, beef production has nearly doubled, reaching

Location

Uruguay

Timeline

2012 to 2017

Land Use

crop production

Partners

Ministry of Livestock, Agriculture and Fisheries; World Bank

Role of Government

regulator, enabler

about 600,000 tons by 2009. Soy production has also increased, from 10,000 hectares in 2002-2003 to 1,300,000 hectares in 2012-2013, mainly by zero tillage, reducing agro-livestock rotation systems, and the increasing presence of global crop players in the country. This desire for higher productivity and greater agricultural intensification is expected to continue to grow over the coming years.

Although this agricultural productivity is supporting the growth of the economy, there is some potential for negative ecosystem impacts, particularly on Uruguay's fragile grassland ecosystems. First are land tenure issues related to the incentives for investment in sustainable usage of land. Currently, two-thirds of agricultural cultivated land is on leased properties, and the incentives for farmers farming this land are for high productivity, with little focus on sustained use. Second, continuous cropping can degrade soils and the

increased use of pesticides and fertilizers will tend to increase the quantity of chemicals reaching and affecting the surrounding ecosystems.

EVOLUTION OF THE INITIATIVE

The Ministry of Livestock, Agriculture and Fisheries (Ministerio de Ganadería, Agricultura y Pesca, MGAP), heeding larger concerns about sustainability, worked together with the World Bank to build on experiences from past joint projects and best global practice, to design the DACC project. The project was designed as a targeted, integrated, and inclusive 'climate-smart' agricultural and rural development program that not only supports efforts to achieve growth in the agricultural sector, but also promotes the adoption of new technologies and sustainable agro-environmental production practices among family farmers and medium-size producers.

The DACC targets are to provide technical assistance and financial incentives, on a matching grant basis, to approximately 4,000 family producers and medium-size farmers to promote investment in economically and environmentally sustainable agricultural and livestock production practices that would improve their resilience to extreme climatic events. The project also aims to provide training to approximately 6,000 farmers, including large farmers, to enhance their capabilities to adapt to an environment of climate change. Training would also be available for about 1,500 rural workers involved in natural resource management activities. In addition to training, farmers' organizations would receive institutional strengthening to improve their capabilities to assist their members with the preparation and implementation of measures aimed at adaptation to extreme climatic events.

MGAP's present policy aims at consolidating the integrated approach practiced in recent years, which promoted the

sustainable use of natural resources while fostering comparative advantages of the agricultural and food sector, particularly among medium-size farmers and family producers. At the same time, Uruguay is a reliable exporter of beef to standards-sensitive markets and it remains highly responsive to increasingly rigorous international food safety and quality standards. However, climate variability, increased demand for Uruguayan beef products in international markets, and increased agricultural intensification all pose challenges to the continued growth of the sector in a sustainable manner.

After the extreme weather events in 2008-2009, the government of Uruguay decided to elaborate a National Agricultural Information System (SNIA, for its Spanish acronym) to use as an early-warning system, as well as a planning tool for farmers. The government coupled this tool with a new law requiring producers farming more than 100 hectares of land to prepare soil-use and soil-management plans to use with SNIA. SNIA not only centralizes and analyzes the soil-use plans produced by farmers for government use, but in addition allows farmers to access better information about soil use and soil management through a host of offered tools. Launched publicly in 2014, SNIA offers several tools that will increase farmers' access to information and support better decision making at a policy level, including an early-warning system for livestock management, an agrochemical control system, rural risk assessments, soil and land use plans, and water studies for irrigation.

In addition to providing information to consumers, SNIA relies on the soil-management plans to provide better information to farmers, specifically to allow them to make better decisions over the long term. In places where no information is available, farmers manage their farms using predictions and historical

knowledge—for example, when to sow, when to move cattle, or when to rotate a crop. Varying weather patterns and changing soil conditions can make these predictions difficult for farmers. Understanding the basic properties of soils leads to better crop management, soil nutrient management, and soil and water conservation. The required soil-management plans and environmental information provided by SNIA help Uruguayan producers accurately make decisions, such as determining soil nutrients that can help manage inputs at sustainable, productive rates. In addition, wide Internet coverage across Uruguay, combined with SNIA, allows agricultural technicians to submit all of their data electronically, thus reducing transaction times.

The soil-management plans, an integral part of Uruguay's sustainability strategy, are supported by legislation and internalized by farmers. In 1982, Uruguay passed a law of Soil and Water Conservation (Ley Nº 15.239), which has been integral to the government of Uruguay's efforts to control erosion nationwide. This law establishes the technical rules for preservation of soils and waters with agricultural purposes and the recovery of eroded soils, entrusting the General Direction of Renewable Natural Resources (RENARE) of the MGAP, which coordinates all activities for the use and preservation of soils. The soil conservation techniques promoted under this law have resulted in the sequestration of 1.8 million tons of carbon per year over the last 20 years.

In 2011, Uruguay piloted a program that required a small group of farmers to present soil-use and soil-management plans to MGAP. The pilot required owners of crop lands to submit growing plans to the respective regional RENARE office, where the plans were certified by an accredited expert who verified that the plans described (1) the process to be carried out

(type of crop, technology, sequence, etc.) and (2) adaptation to the land's use capacity or suitability. RENARE used a simulation model for land loss due to erosion called Erosion 6.0 to determine whether the growing plan was sustainable or not. The MGAP also planned to use satellite imagery to oversee the execution of the plans. In 2013, this pilot was scaled and soil-use and soil-management plans became a requirement for any farmer cultivating more than 100 hectares of land. Now, more than eight percent of the country is covered by approved soil-management plans.

The DACC project is supporting the government to train agricultural engineers and extension agents to support farmers in the preparation of these plans. Training modules, both online and in person, teach these engineers and extension agents to prepare soil-use plans according to national guidelines, and guide farmers in how to use and apply these plans. In addition, the DACC project is supporting MGAP to identify farmers working more than 100 hectares of land that have failed to prepare soil-use plans.

The maps in Figure 1 demonstrate the erosion and degradation of Uruguayan soils, and the focus of the soil-use plans presented to MGAP. More than 11,587 soil-use plans from across the country have been submitted and approved by MGAP, covering more than 1.43 million hectares or eight percent of the total area of Uruguay.

Historically, RENARE has been the lead in supporting national soil databases and geomorphological maps. It has played an integral part in the ongoing development of SNIA, and has contributed national soil data and geomorphological maps to this database. With the support of the DACC project, RENARE is also undertaking work to rank soils suitable for agriculture, which will be digitized and made available via the Internet at different depths depending on the user's interest.

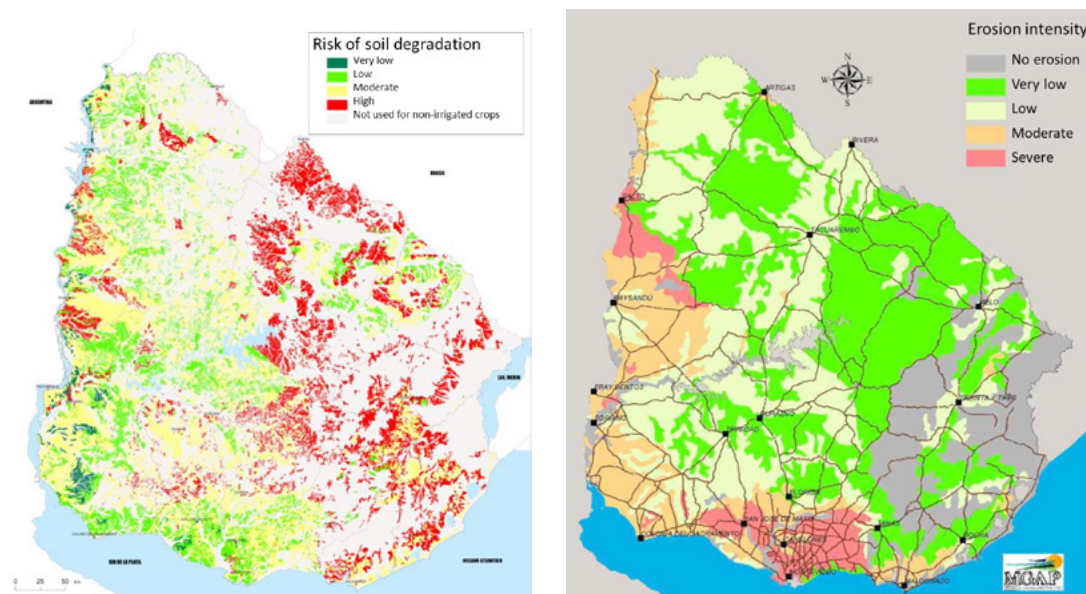


Figure 1. Degradation and erosion in Uruguay. Source: RENARE, Ministry of Livestock, Agriculture and Fisheries

The MGAP also relies on the CONEAT index, which is structured by the MGAP and the National Commission of Agroeconomic Study of the Earth (CONEAT) and determines the actual capacity of the soils of the country, evaluated in kilograms of bovine and ovine meat and kilograms of wool by hectare of natural fields, whose average is index 100. The CONEAT serves as the basis for the definition of forestry priority of soils under the current legal framework of the corresponding policy. RENARE is currently working, with support from the project, on correcting the geo-referencing of the CONEAT mapping and updating the CONEAT software. As can be seen in Figure 2 the most fertile soils are found in Uruguay's western/southwestern fringe, ranging from dark blue (high fertility) to red (poor fertility). The final maps will be included in SNIA, can be contrasted to soil-use plans produced by farmers, and can be accessed by producers throughout the country. According to RENARE, soil-management plans to date have proven, through meticulous data collection and hundreds of soil-use and soil-management

plans, how Uruguay agriculture generates high production with less erosion potential. This places Uruguayan agriculture in international markets as a higher-efficiency choice for agricultural products.

ANALYSIS AND LESSONS LEARNED

Part of Uruguay's recent economic success can be attributed to the country's efforts to systematically identify the binding constraints to agricultural growth, and then lift them. The process of eliminating these constraints was carried out first through a program to improve farm-level sanitation through the development of a national-level system for individual cattle traceability (Sistema Nacional de Información Ganadera—SNIG). Currently, in the context of a changing climate and concerns about sustainable grasslands and water management, Uruguay is focused on how to intensify production while simultaneously conserving and protecting natural resources for sustainability in the long term. In order to do this, MGAP has adapted its policies to handle new challenges and constraints to agricultural growth and

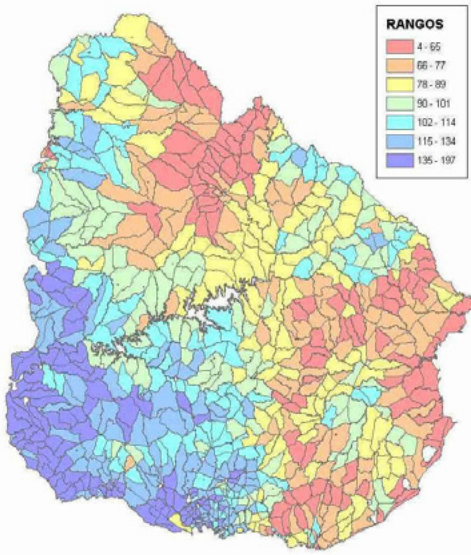


Figure 2. Average Productivity Index.
Source: CONEAT

intensification—better information and tools for farm management practices—and has increased focus on natural resource management for sustainability, emphasizing the importance of soil-use plans for sustained growth.

Uruguay has a unique long-term vision for sustainability, which is reflected in the collective vision of MGAP employees and administrative structures of the Ministry. The Project Implementation Unit set up for the DACC project also now manages several government projects that receive donor funding, including funding from the Climate Fund for Adaptation. This assimilated approach allows close collaboration between projects and fosters institutional memory within the Ministry across projects.

As part of its work on soil-management projections, DACC is collaborating with the International Research Institute for Climate and Society (IRI) from Columbia University, specifically on climate modeling as an input to SNIA. Many national-level climate predictions are based on models with large predictive variability,

and reduce the appearance of uncertainty through averages. Using real information from soil-management plans and national information databases, Uruguay has created a climate change indicator that examines the impact of weather events on the variability of production. Uruguay is unique in its ability to create a specific indicator based on concrete, real-time data. Soil-management plans provide valuable, actionable inputs to this model and allow the government of Uruguay to make accurate predictions based on the actual situation in Uruguay. The predictions are useful at the policy level, but can also be used to inform planning of farmers. Layering data and analyzing for vulnerability provide farmers with a more accurate, more comprehensive view of vulnerability and risk and allow farmers to make informed decisions about medium-term and long-term planning.

In 2013, 500,000 hectares were planted with wheat and barley, a figure that matches the total number of hectares submitted by the producers to RENARE. Officials from RENARE note that, if there were cases of noncompliance, there were very few. In 2014 and beyond, the authorities hope to receive soil-use and soil-management plans to cover one million hectares of agricultural land. Despite wide-scale adherence, soil-management plans have faced some implementation challenges. Despite large-scale awareness campaigns, training by the DACC project of agronomists in the elaboration of these plans, and large-scale uptake, the mechanism for enforcement of the promised penalties has been weak. To strengthen detection and enforcement, the government has considered geo-sensing of soil use via digital geo-sensing, but, in order to be current, this needs to be done frequently and the digital imaging is prohibitively expensive. In addition, despite wide-scale coverage for crops, the vast majority of land is covered by livestock

and dairy production. In early 2014, the government started thinking about soil-use plans for the cattle ranching sector. However, because this process is so new, compliance and update have not yet been determined. One of the next steps for these soil-management plans will be thinking about how to successfully scale this program beyond the agricultural sector.

In the places where the soil-management plans have succeeded, the accomplishment of the implementation of these plans can be partially attributed to the government of Uruguay's enforcement efforts, but a large portion of the success is due to the personal commitment of small farmers to sustainability on their farms. Individual farmers frequently pay for services of technicians who help them prepare soil-use and soil-management plans. RENARE, with the support of the DACC project, has produced videos, maps, guidebooks, and workshops to train technicians in the proper elaboration of these plans. RENARE makes all necessary information available on [its website](#), and this real-time information is crucial for the success of the project.

One of the biggest innovations of the DACC project is SNIA—by integrating information from nationally supported soil-management plans, together with the CONEAT index and other shared data, SNIA provides richer information for policy makers in the government of Uruguay, allows consolidation of soil-management plans and other relevant data, and, when launched publically, will provide producers throughout the country with rich tools to geo-locate and track soil use throughout the country. SNIA supports MGAP's focus on the long-term sustainability of growth by integrating information about water and soil use and providing information that allows all farmers, regardless of scale, to make better decisions about management practices. SNIA is unique in the region, and, although several other

countries are trying to launch similar platforms, none are as advanced as Uruguay's SNIA.

The innovation and success to date of the project have not been without challenges. Despite Uruguay's rich repository of data and the clear use of information in policy applications, it has been challenging to think about how small producers will use the soil management information and other information included in SNIA in applications on their own farms. To address this challenge, MGAP nominated experts from the government, research institutions, and the private sector to participate in working groups to develop distinct tools to specifically address the challenge of how to package the data so that producers can use them concretely to make decisions. The result of this will be at least nine separate products, each with its own specific purpose, and including early-warning systems, rural risk assessment, water studies for irrigation, and the data generated by the soil-management products supported by the project.

Uruguay is unique in many ways that make scalability to other countries difficult. It is a small country, with only three million people, where nearly two million of its inhabitants live in the capital Montevideo and surrounding area. In 2013, Uruguay became a high-income country, with a per capita GDP of US\$14,449.50 (2012) and a Gini index of 45.3 (2010), the lowest in Latin America. It is exceptional in terms of land use—Uruguay has some 85 percent of its land suitable for agricultural production, one of the highest in the world; and the Law on the Use of Conservation of Water and Soil has led to large-scale carbon sequestration and better land-management techniques across the country, thus further increasing the quality of suitable land.

Although many countries across the world, including many in Latin America,

struggle with data collection, data comparability, and data analysis, Uruguay has rich databases and censuses that date back to 1920. In addition, there is reliable and prolific Internet access, and the education system has historically been good, and as such there are no illiteracy constraints. In addition, farmers throughout the country receive, and in most cases pay for, agricultural extension services of agronomists and engineers to assist them in their production and help them prepare required soil-use plans. For all of these reasons, and many more, the experience of Uruguay cannot be easily replicated elsewhere. However, the technologies used and the strong vision for long-term sustainable growth are things which other countries can adopt.

INTEGRATED PEST MANAGEMENT VIA MULTI-STAKEHOLDER COORDINATION, USA

A. Ann Sorensen and Thomas J. Greitens

4

SUMMARY

The United States Environmental Protection Agency (EPA), its regional branches, and the American Farmland Trust, a nongovernmental nonprofit, refocused a small grants program (the Strategic Agricultural Initiative or SAI) to consider performance measures and outcomes and helped growers of specialty crops on more than 780,000 acres transition away from high-risk pesticides.

BACKGROUND

Passed in 1996, the Food Quality Protection Act (FQPA) transformed the way EPA regulated pesticides. The FQPA emphasized new ‘reasonable certainty of no harm’ risk assessments for pesticides, reassessments of existing pesticide tolerances, and the complete phasing-out of the highest-risk pesticides. EPA hoped the phase-out would encourage and facilitate a transition to safer alternatives and reduce risks to farm workers, pesticide applicators, and aquatic ecosystems. Concerned that the phase-out could create a variety of problems for growers, the FQPA also required EPA and the United States Department of Agriculture (USDA) to develop programmatic inducements that helped growers research and use integrated pest management (IPM) techniques and a variety of newer, lower-risk pesticides (Food Quality Protection Act, 1996). EPA’s Office of Pesticide Programs established the SAI program specifically to help fruit, nut, and vegetable growers. Although these specialty crops were high in value, they were grown on less than four percent of the total harvested cropland in

Location

USA

Timeline

1998 to 2007

Land Use

specialty crops

Partners

government, NGOs, producers

Role of Government

funder, promoter

the United States and represented a minor market for pesticide companies. EPA feared that developing and registering lower-risk replacement pesticides would be a lower priority for the companies, thus putting growers in a bind. The agricultural census surveyed specialty crops for the first time in 2007 and found 247,772 farms that grew specialty crops on 13,766,444 acres, with a market value of US\$67 billion (USDA, 2009).

EVOLUTION OF THE INITIATIVE

Started as a pilot program in 1998, the SAI program grew into a national program with ten staff members managing the program across the ten geographically diverse EPA regions. The mission of the program was to “support and promote environmentally sound agricultural and pest management practices across the United States that [were] economically viable and socially responsible” (Environmental Protection Agency, 2007). The program’s mission was primarily achieved

through funding opportunities and education-based outreach endeavors. The funding opportunities, in the form of small research or demonstration grants, allowed growers and researchers to increase their knowledge and use of safer pesticides and various IPM-based strategies. Typically, these funding opportunities emphasized a systems-based approach that integrated pest, soil, water, and crop management practices. Additionally, they included significant provisions for outcome-based performance measurement, with project results recorded in quantifiable and verifiable ways. Outreach endeavors included the use of workshops and various promotional materials that informed growers about the latest reduced-risk strategies. In this way, the program attempted to directly measure the results of innovative reduced-risk strategies with funding opportunities and then tried to diffuse those innovations to a larger grower population via outreach-based events. The projects designed their outreach efforts to best fit the needs of the producers in their locations but included field days where producers could see IPM tactics in action and query fellow farmers about their effectiveness, presentations by researchers at producer meetings, innovative websites with podcasts or videos of farmers talking about the use of IPM on their farms, and newsletters sent directly to farmers updating them on the results of various projects on a regular basis. Projects that used weather stations and computer modeling or monitored pest populations to help producers decide when to take action provided continual access to that information via websites and weekly paper or electronic newsletters.

To assist in those endeavors, the SAI program partnered with the American Farmland Trust (AFT), a nongovernmental non-profit organization founded in 1980 by a group of farmers and conservationists to

address the loss of United States farmland to development. AFT's mission is to protect farmland, promote sound farming practices, and keep farmers on the land. AFT had a long history of working with growers on policy issues and its research director was an entomologist with years of experience with IPM. In 1997, EPA reached out to AFT to help oversee large IPM implementation projects. As a result, AFT brought both management skills and experience with IPM strategies for high-value crops to the SAI program. More importantly, AFT had started applying logic models¹ to improve the outcomes of its IPM work. Consequently, AFT had the requisite skills to help the SAI program focus its limited funds more strategically and document the outcomes.

Funding for the SAI program ended in 2012. During its history, the program, although modest in size, helped more than 15,000 growers safely reduce their use of and dependence on high-risk pesticides (American Farmland Trust, 2012). The program also helped growers apply reduced-risk management practices on more than 780,000 acres of farmland in the United States, and reduced the use of high-risk pesticides on those acres by more than 30 percent (Environmental Protection Agency, 2007). These successes helped growers transition away from higher-risk pesticides while still remaining financially viable. The projects did not directly measure the environmental impacts because of the expense in monitoring, but various projects noted that beneficial insects and pollinator populations increased, water quality probably improved, and farm workers were exposed to fewer pesticides.

1 Logic models (also known as a logical framework, theory of change, or program matrix) are tools that can be used to evaluate the effectiveness of a program. The underlying purpose is to figure out the "if we do this, then this happens" relationships. Projects are designed with the customer in mind—in this case, whatever it takes to ultimately change the behavior of producers.

ANALYSIS AND LESSONS LEARNED

The United States Congress stipulated that EPA not duplicate research undertaken by other agencies, so SAI had to find its own niche in funding IPM-related projects. Funding was limited to US\$1.5 million per year and grants were used to help develop innovative IPM techniques that helped address FQPA priority issues in the different EPA regions. Grants used a new outcome-based funding model that required potential grantees to link IPM-based adaptive management approaches to specific environmental targets. Achieving consensus on these specific environmental targets was difficult due to the distinct geographies, different environmental concerns, and dissimilar pressures on growers in each EPA region. Nonetheless, EPA and American Farmland Trust trained regional EPA staff in an outcome-based model that recognized these wide differences across regions.

For example, in Massachusetts and New York, where apple orchards are often small and may be surrounded by residential housing, spraying pesticides was problematic, so one project developed quantifiable, science-based IPM performance standards and helped growers market their crops to consumers by featuring the environmental benefits. In New Jersey, similar challenges with residential development led to two projects focused on biological control—using wasps to control Mexican bean beetles on soybeans to reduce the need for pesticides on subsequent edible bean crops (snap beans and lima beans) and using predatory mites in high tunnels (greenhouses) to control spider mites on tomatoes and peppers. Yet another project in the expansive cotton-growing areas of the southern United States used satellite-based global positioning systems (GPS) to identify areas with plant parasitic nematodes (based on topography and

soil texture) so producers could treat just those areas. In Indiana and Iowa, projects tried to develop comprehensive management strategies that could combat fungal diseases threatening muskmelon crops. In Montana and Idaho, projects focused on sugarbeet production, using biological controls, host-plant resistance, reduced rates of pesticide application, and the increased implementation of improved predictive computer models to overcome problems with sugarbeet root maggot and several fungal and bacterial diseases.

Several projects in California and Michigan developed IPM tactics for wine grapes and helped contribute to the development of the California Association of Winegrape Growers and Wine Institute's Sustainable Winegrowing program. This influential program gives growers and vintners educational tools to increase the adoption of sustainable practices and to measure and demonstrate ongoing improvements that can then be featured in marketing. Agency staff, AFT staff, and academics then reviewed grower proposals and awarded funding based on the probability of success for project outcomes. Projects included strategic planning for the southern sweet potato industry that resulted in a US\$2 million USDA grant, weed suppression by flooding in commercial cranberries in the Northeast that dropped producers' pesticide costs by 94 percent, IPM training in Spanish for Hispanic orchardists in Washington State, an ag-weather network for farmers in the Pacific Northwest that helped growers use IPM tactics on more than a million acres of cropland, a web-based tool to help farmers choose the lowest-risk pesticides, and the use of codling moth mating disruption to protect more than a third of Michigan's fruit orchards.

AFT developed a unique online searchable database for these grants that made it easy to compile performance outcomes across EPA regions and also report on

several important variables, including how many farmers were served, the number of acres affected, pesticides targeted, pests addressed, alternatives used, and how many farmers on how many acres implemented IPM as a result of the projects. These variables were part of the SAI program's unique set of a variety of performance measures that included overall project measures (e.g. number of acres to be affected, current level of pest management, percent reduction in high-risk pesticides) and environmental performance measures (both direct and surrogate measurements to determine whether projects improved environmental quality). The environmental performance measures were grouped into nine categories: dietary, human, behavior, economic, soil, water, air, plants, and animals. To help them integrate the appropriate performance metrics into their projects, potential grantees were directed to the SAI Toolbox website, which was maintained by AFT. Because of the wide differences in environmental and grower concerns across the different EPA regions, this type of performance integration tool was important.

To further track performance across the EPA regions, the program also employed a unique SAI Transition Index that measured the progress of growers toward full implementation of an IPM program. This was important since moving growers along an IPM continuum of practices tends to be more difficult as more strategies and tactics are adopted and the intensity of management increases. Finally, the use of outcome funding and IPM logic models greatly improved the success rate of the projects and changed the way many university researchers designed their projects.

In addition to collecting data on project successes, the SAI coordinators in each EPA region also kept track of grower meetings and contacts, encouraging a two-way dialogue between the agency that

was regulating growers and the growers who were trying to follow the regulations. This type of dialogue was unique and, when coupled with the small research and demonstration projects, was quite powerful. Although several laws such as FQPA have mandated EPA's oversight and regulatory responsibilities to reduce risks from chemicals used on food and the use of pesticides, agency staff rarely have the chance to interact with growers to learn first-hand how pesticides are being used. The SAI program encouraged regional staff to interact with growers and commodity groups, and to help them identify potential problems in controlling priority pests as high-risk pesticides were discontinued. The program helped growers and regulators communicate and work together to find ways to reduce risks while maintaining crop yield and quality. Bringing in AFT, researchers, and personnel from USDA helped motivate the SAI coordinators to work together, improve the granting program, track their progress, and function as a team. Working with the nongovernmental nonprofit group was essential since developing and maintaining the necessary databases to track progress would have been challenging within the bureaucracy of a federal agency.

Overall, the SAI program's use of different types of performance measures, emphasis on collaboration with growers, and the integration of disparate projects into one cohesive data collection system worked relatively well in the field. Aside from insufficient funding to match the program's needs, challenges mostly occurred in having timely and accurate data reporting from hundreds of SAI projects. However, the program became especially beleaguered by narrow agency prescriptions on what type of performance outcome data should be collected and how those data should be linked back to programmatic design (Environmental Protection Agency, 2007).

Concerns such as these eventually led to less and less involvement by AFT and other external actors, so the program became less adaptable in being able to meet the needs of different types of growers in different regions of the country and it faded away. There were other factors in play as well—the internal agency coordinator for the program who had championed the program and had greatly improved its accountability was transferred to another branch, funding for the agency was reduced by Congress, and the priorities within the agency shifted to promote IPM in urban settings such as public schools. Maintaining programs such as the SAI for the long term may require Congressional support (which requires a strong demonstration of public support for the program from constituents) and access to a dedicated funding source reinforced by legislation. However, the remarkable success achieved with limited funding showed that a public-private collaboration with the right partners and a strategic focus on outcomes can make a huge difference.

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DAIRY SUSTAINABILITY COMMITMENT: VOLUNTARY CONTINUOUS IMPROVEMENT, USA

Thomas Gallagher and Jim Mulhern

5

SUMMARY

Since 2008, the United States dairy industry has worked together—from farm to retail, and with experts from academic, government, and nongovernmental organizations—to build on its heritage of stewardship and continuous improvement. Its approach spurs voluntary actions through economic incentives for improvements and innovations that deliver environmental and community benefits.

BACKGROUND

The US\$125 billion United States dairy industry (International Dairy Foods Association, 2013) includes nearly 50,000 licensed dairy farms in all 50 states (National Milk Producers Federation, 2014). Some 97 percent of these are family owned (USDA, 2010). Annual U.S. milk production exceeded 200 billion pounds (90.7 billion kilograms) of milk for the first time in 2012. With 9.2 million cows, the U.S. is already one of the highest producers of milk per cow in the world (FAO, n.d.), with one of the smallest carbon footprints per gallon/kilogram of milk (FAO, 2010).

Like many other food and agricultural producers, the U.S. dairy industry faces growing and changing demands to produce nutritious dairy products, while conserving natural resources and minimizing environmental impacts. Milk and dairy foods provide an important, efficient, and economical package of nutrients, including protein, calcium, and seven other vitamins and minerals. Producing them requires land; feed for cows; energy to cool milk and process dairy products; water for

Location

USA

Timeline

2008 to present

Land Use

livestock

Partners

industry, government, NGOs, producers, universities, research institutes

Role of Government

promoter, funder

crops, cows, and processes in the milking parlor and dairy processing facility; and fuel to transport and distribute milk and dairy products (including materials and energy to package products for consumers). Although these basic resources haven't changed substantially over the years, what have changed are the technologies and science-based practices that have enabled members of the industry to achieve substantial increases in efficiency. Compared with 1944, the dairy industry now produces a gallon of milk using 90 percent less cropland and 65 percent less water, generating 75 percent less manure and a 63 percent smaller carbon footprint through production efficiencies, cow nutrition management, and other improvements (Capper, Cady, and Bauman, 2009).

Environmental factors such as water scarcity, climate change, and decreasing availability of arable land present ongoing challenges. In North America, net arable

land is projected to continue to decline annually by two percent because of urbanization and development (OECD and FAO, 2009). Life Cycle Assessment (LCA) studies enable the dairy industry to determine the environmental impact and identify risks and opportunities across the value chain, beginning with feed production for dairy cows; continuing with milk production, transport, processing, packaging, and distribution to retailers; and ending with consumers who purchase and use dairy products. Science is the foundation for decisions, informs the development of best practices, and helps establish goals and measure progress.

The dairy LCAs follow ISO 14040, 04044 standards and were published in the peer-reviewed International Dairy Journal. They established that the U.S. dairy industry is responsible for two percent of total U.S. greenhouse gas (GHG) emissions and 5.1 percent of total U.S. water withdrawal (Miller and Wang, 2013).

EVOLUTION OF THE INITIATIVE

As the global population grows, access to foods that are nutritious, affordable, and respectful of biodiversity and ecosystems will be critical for the health of future generations. Nutrient-rich milk and dairy

foods play a vital role in a sustainable food system, providing a distinct source of nutrients essential for good health. The U.S. Dairy Sustainability Commitment is based on a dedication to help meet the challenges of a world where concerns of climate and economics meet ones of public health and food access. It is facilitated by the Innovation Center for U.S. Dairy®, which was established under the leadership of U.S. dairy farmers. The goal is to provide consumers with the nutritious dairy products they want, in a way that makes the industry, people, and the earth economically, environmentally, and socially better—now and for future generations.

This commitment began in 2007 when the board of directors for Dairy Management Inc.—which builds demand for dairy products on behalf of dairy farmers and dairy importers—chose to take a proactive approach to sustainability. The board’s actions were prompted by changing consumer perceptions about what constitutes a food that is ‘good.’ A growing number of consumers want to know not only whether a food is good for them; they also want to know where their food comes from and how it is produced. This marketplace trend was emerging as a macro trend. As noted in a 2007 IRI Report, “sustainability has

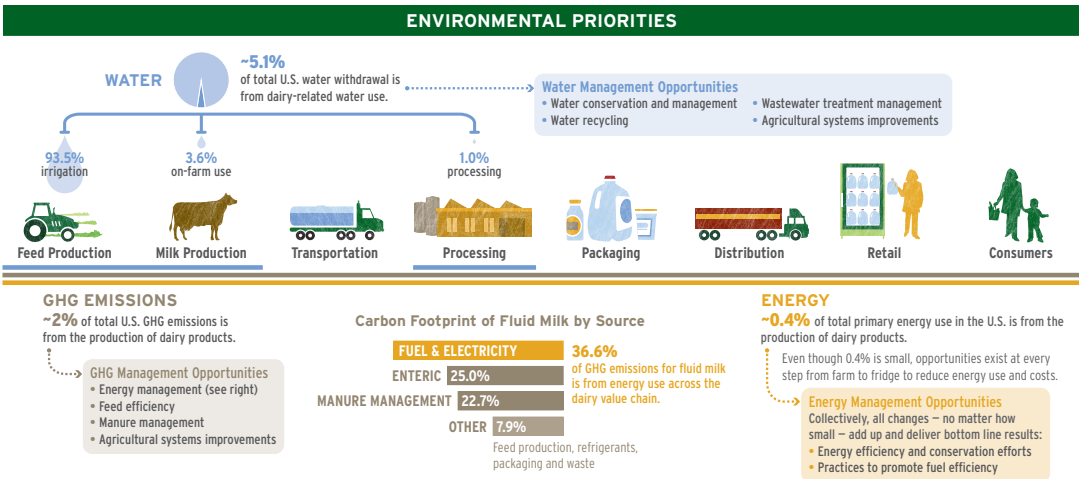


Figure 1. Environmental Priorities for the dairy supply chain.

evolved from buzzword to guiding business principle.... A viable consumer market has emerged for sustainable CPG products and packaging.”

Dairy farmer leaders also recognized that decisions made for good business reasons can also deliver positive environmental benefits. With this in mind, they convened leaders from dairy companies, cooperatives, and suppliers, as well as academia and government and nongovernmental organizations at a three-day summit to focus on opportunities to build business value and reduce GHG emissions across the supply chain. The outcome was a shared sustainability vision, guiding principles, and a voluntary, industry wide goal to reduce GHG emissions for fluid milk by 25 percent by 2020, using a 2007-2008 baseline established by LCA research. Participants then identified practical ways to reduce GHG emissions while increasing business value across the value chain. Work on these projects began in 2009. These efforts have gained momentum and delivered results across the value chain as a result of the dairy industry’s pre-competitive, collaborative approach.

The Sustainability Council is a stakeholder advisory group representing more than 100 dairy organizations as well as scientists, suppliers, academics, and government representatives. Strategic partnerships provide valuable expertise and resources, and include the nongovernmental organization World Wildlife Fund; the Center for Advanced Energy Studies, a research and education partnership; and government organizations—U.S. Department of Agriculture (USDA) and U.S. Environmental Protection Agency (EPA).

In particular, in 2009, the Innovation Center for U.S. Dairy and USDA signed a three-year Memorandum of Understanding (MOU) as an expression of their joint commitment to improving dairy sustainability. The government agency chose this

approach to support the industry’s proactive, voluntary goals and efforts; the MOU would help advance these efforts by aligning government resources with the industry’s projects. Specifically, the partnership aims to advance research and projects that improve the economics of sustainability, support innovation opportunities, and provide dairy farms and companies with access to funding that helps them continuously improve their environmental stewardship and sustainability.

Progress made since 2009 indicates that the partnership is effective and expanding. Dairy farms and companies are taking more and more voluntary actions, and government agencies have identified opportunities to encourage these voluntary actions. In the first three years of the partnership (also see Figure 2):

- Under the Natural Resources Conservation Service (NRCS) Environmental Quality Incentives Program, more than 6,000 dairy farms received a total of US\$287 million to plan and implement conservation practices that improve the sustainability of their working lands.
- NRCS helped dairy producers across the country advance their goals by implementing environmental improvement projects, including:
 - More than 200 air quality projects;
 - Nearly 14,000 soil quality and fertility projects (grazing, cropland, and riparian buffers); and
 - More than 10,000 barn improvement and manure nutrient management projects.
- Under the Rural Energy for America Program, 180 anaerobic digesters—which convert cow manure into valuable by-products including renewable energy—were installed.
- Technical and financial resources were provided to members of the dairy supply chain to help them reduce on-farm

energy use and related costs:

- ❑ The Innovation Center and USDA developed [Save Energy](#) to connect dairy producers to financial assistance programs and educational materials;
- ❑ More than 350 on-farm and in-plant energy audits were conducted to help identify opportunities to reduce energy use, costs, and greenhouse gas emissions; and
- ❑ More than US\$600,000 in cost-sharing grants were provided for energy efficiency equipment implementation, resulting in a reduction of approximately 7,000 metric tons of carbon dioxide equivalent (CO₂e), which is equal to taking 1,500 cars off the road for a year.

The partnership was renewed in 2013, and in early 2014 USDA helped advance the development of a Biogas Roadmap. This interagency plan announced by the White House brings together USDA, the Department of Energy, and EPA to work with the dairy industry to accelerate the adoption of biogas systems and other cost-effective technologies that reduce methane emissions on farms.

The Biogas Roadmap was announced by the Obama Administration as part of its [Climate Action Plan: Strategy to Reduce Methane Emissions](#). In the plan, the work of the Innovation Center for U.S. Dairy is cited as an example of leadership in the private sector to reduce methane emissions. As a result, the administration's strategy to reduce methane emissions for agriculture is currently based on cost-effective voluntary actions, not increased regulation. The Biogas Roadmap is designed to stimulate research and technology and provide financial and technical assistance to the dairy industry through voluntary programs.

Likewise, the industry's partnership with World Wildlife Fund has grown, as has

the work with research institutions. The original scope focused on understanding and quantifying the dairy industry's environmental impact, and is now broadened to identify and advance mitigation opportunities that deliver triple-bottom-line impact.

A fundamental challenge faced from the beginning was building consensus across the dairy industry, which includes nearly 50,000 dairy farmers, dozens of cooperatives, hundreds of dairy companies, and thousands of retail and branded companies. Through the Innovation Center, the dairy industry took a deliberate approach to work together pre-competitively, sharing best practices and co-creating guiding principles, goals, and a vision for the future. Although many individual actions are already being taken, the commitment does not stop here. The industry will continue efforts to understand and address other environmental, social, and economic risks and opportunities. Industry-wide adoption and implementation of the science-based sustainability tools and resources are a top priority to help drive meaningful change.

ANALYSIS AND LESSONS LEARNED

The U.S. Dairy Sustainability Commitment has several interesting lessons and implications.

Economic Incentives can Spur Voluntary Action

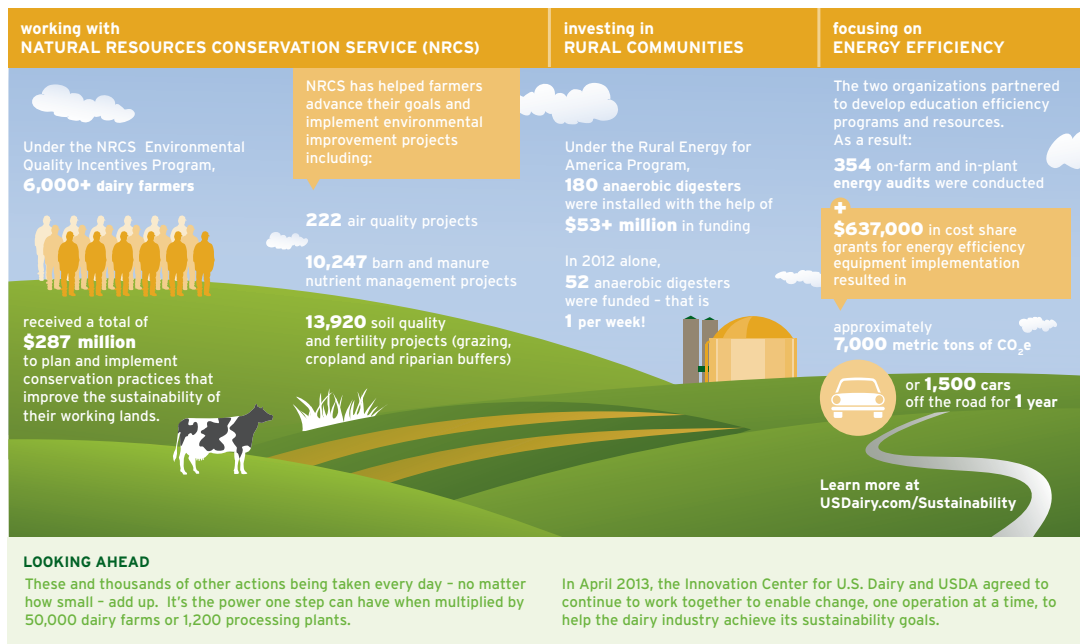
The sustainability progress of the dairy industry—or any sector—depends on long-term economic vitality at each step in the value chain. A focus on cost savings and business value can spur significant progress in many areas—more so than regulatory standards. In its Climate Action Plan, the Obama Administration stated: “Through partnerships with industry, both at home and abroad, we have already demonstrated the technology and best practices to deliver substantial reductions in methane

Innovation Center for U.S. Dairy and USDA Partnership

3 YEARS OF PROGRESS



In 2009, the Innovation Center and the U.S. Department of Agriculture (USDA) signed a three-year Memorandum of Understanding as an expression of their joint commitment to improving dairy sustainability. In the first three years of the partnership, thousands of dairy farmers were able to make progress toward their conservation and sustainability goals.



U.S. DAIRY SUSTAINABILITY
COMMITMENT



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Figure 2. U.S. Dairy and USDA partnership achievements

emissions. These cost-effective steps can deliver multiple benefits,” including economic, climate change, public health, and safety.

The industry used Life Cycle Assessment of GHG emissions to set reduction goals and identify opportunities for improvement. Economic analysis accounted for associated cost reductions and revenue opportunities. Net present value analysis considered the cost of implementation and cost of capital. This formed the basis for the industry’s Roadmap to Reduce Greenhouse Gas Emissions and Increase Business Value, endorsed by the Innovation Center in 2009.

Communication to farmers about these opportunities is an ongoing process. Support and endorsement from leaders of dairy cooperatives and other farmer leaders are critical. The dairy industry emphasizes

that improvements must make good business sense, and tools such as Farm Smart™ will help to quantify not only the environmental impact but also the economic impact of practices. The dairy industry highlights best practices through case studies, articles in dairy industry publications, and conferences. The U.S. Dairy Sustainability Awards program honors the ‘best of the best’ and provides stories of best practices and innovations to share with farmers.

Foster Collaboration among key stakeholders

The initiative’s success to date is rooted in the broad spectrum of groups involved in its continual development, implementation, and evaluation. From the beginning, many different stakeholders, including dairy farmers, food processors, retailers, academics, government officials, nongovernmental organizations, supporters, and

skeptics, were included. The appreciative inquiry approach served to identify common goals, incorporate diverse perspectives, and unearth resources that could be brought to bear on the challenges and opportunities before the industry.

Participants in the first meeting came together to examine climate change, which was an emerging issue in the United States. Participants recognized that it was bigger than any one company or segment of the supply chain could address alone. Though the supply chain had never worked together in this way before, appreciative inquiry was extremely effective. The first goal was a dual goal: to reduce GHG emissions and increase business value.

Government officials contributed to collaboration in three unique ways: as co-developers, vocal public supporters, and facilitators. Government agencies sent their researchers, scientists, and managers to participate in planning meetings and sat alongside industry and other stakeholders as co-developers of the initiative. In this way, they acted not as traditional regulators, but as valued contributors. They were also equipped to facilitate change within their own agencies, as appropriate; for example, reviewing existing policies that might have unintended barriers to desired change or innovation, and creating inter-agency strategies.

This process is a voluntary collaboration between the federal government and the dairy industry, as opposed to a command and control process by which mandates are imposed.

Transparent Communication and Public Recognition is critical

Transparent communication and public recognition of the initiative's progress have been crucial in motivating voluntary change and sustaining the initiative.

- Policy makers, for example, have publicly acknowledged industry progress in public statements/speeches, on websites,

in social media, and through the joint industry-government MOU. In other words, celebrate the benchmarks along the way; do not wait until 100 percent success can be declared. This acknowledgment encourages continued commitment and support from existing and new partners.

- The U.S. Dairy Sustainability Awards publicly recognize dairy farms, businesses, and collaborative partnerships for efforts that deliver outstanding economic, environmental, and social benefit, thus helping advance the sustainability of the dairy industry. Public and private sponsors provide program support and help communicate these success stories. Now in its third year, the program has recognized 21 winners and garnered coverage in national and local publications across the country. World Wildlife Fund shared their stories on this [consumer website](#).
- The industry has also published three sustainability reports to update stakeholders on the progress of the U.S. Dairy Sustainability Commitment. The reports discuss topics most relevant to the industry's environmental, economic, and social impacts. This conforms to the Global Reporting Initiative sustainability reporting framework.
- The Innovation Center led the development of the Stewardship and Sustainability Guide for U.S. Dairy, which provides a common language for dairy farmers and processors to measure the impacts that matter most to their overall environmental performance, set goals, and report on their progress. The Guide was developed by representatives from dairy farms, processors, brands, retailers, academia, and governmental and non-governmental organizations.

Place Science in the Hands of Decision Makers

In its Life Cycle Assessment research, the Innovation Center found significant variability in environmental impact of farms, processing plants, and transportation fleets. Importantly, it showed that the basis for environmental impact is not region, size, or age of the operation, but best management practices. Key opportunities include:

- GHG management
 - Energy management
 - Feed efficiency
 - Manure management
 - Improvements in agricultural systems
- Water management
 - Water conservation and management
 - Water recycling
 - Wastewater treatment management
 - Improvements in agricultural systems

The variability in environmental impact means that best management practices can make a difference if they are advanced and shared with others. The more they are shared, the more the entire industry will move toward greater efficiency. Such proactive and voluntary change by dairy farmers is initially enabled by providing them with the tools, science, and data they need to make better management decisions—and the ability to assess both environmental and economic implications of changes and improvements in practices.

U.S. government agencies augmented investments by NGOs and dairy farmers with a US\$9.9 million grant through USDA's Coordinated Agricultural Projects program. This program brings together teams of researchers that represent various geographic areas to support discovery and applications and promote communication leading to innovative, science-based solutions to critical and emerging national priorities and needs. In their quest to identify

opportunities to reduce GHG emissions, multidisciplinary research teams will look at all aspects of milk production—dairy rations and dairy cow genetics, manure handling and storage, crops, tillage and rotations—to identify systems that are most effective at retaining carbon, nitrogen, and water while maintaining healthy financial bottom lines. The project's goals are:

- To increase the resiliency of dairy production systems in response to climate change;
- To reduce the environmental impact from dairy production systems, particularly GHG emissions;
- To develop decision support tools for management practices that dairy producers implement at the farm level; and
- To educate farmers and other members of the public on sustainable management practices for dairy production systems.

The project is led by the University of Wisconsin-Madison and involves researchers and extension staff from seven universities, five federal labs of the U.S. Departments of Agriculture and Energy, and the Innovation Center for U.S. Dairy. The Innovation Center is taking the lead in the development of the Farm Smart™ tool. This tool will provide environmental information that helps farmers assess, measure, mitigate, and communicate continual improvement toward stewardship and sustainability.

Small Steps Add Up

Since their 2009 launch, the greenhouse gas reduction projects have expanded in scope and helped dairy farms and companies assess and improve their environmental impact. The following are highlights from the projects (U.S. Dairy Sustainability Report, 2013).

- The Farm Smart™ tool has been piloted by dairy farms in 11 states.

- Since 2011, 667 farm energy audits have identified more than US\$2 million in potential cost savings, more than 55,500 million British thermal units (MMBtu) in potential energy savings, and more than 11,500 metric tons of CO2 equivalents in potential GHG reduction.
- Since 2011, 197 dairy digesters in operation were generating an estimated 7.6 million MMBtu of renewable energy, with 4.7 metric tons of CO2 equivalents in reduced GHG emissions, equal to taking 999,096 cars off the road for one year.
- Since 2010, 29 dairy plants achieved the ENERGY STAR challenge, an EPA program that recognizes individual dairy plants that have reduced their energy intensity by 10 percent within five years. Some 148 dairy plants are enrolled, representing a considerable percentage of the companies participating in the challenge.
- The Innovation Center earned the EPA 2012-2013 SmartWay Affiliate Challenge for exceptional efforts to promote sustainable transit through the Dairy Fleet Smart project.
- Sustainability Council members are taking action and setting public goals and commitments. For example: Schreiber Foods set a goal to reduce energy

and carbon production intensity by 25 percent; United Dairymen of Arizona installed a new heat-efficient evaporative system in its 13 acre Arizona plant, which is expected to save more than US\$1 million in natural gas costs and approximately 1,100 metric tons of CO2 equivalents annually; dairy companies such as Prairie Farms Dairy Inc., Oakhurst Dairy, and the Kroger Company are sharing their GHG reductions through the Carbon Disclosure Project; Glanbia USA reduced its water consumption by 27 percent between 2010 and 2012; Bel Brands USA decreased its water consumption by 19.8 percent between 2008 and 2012; and Hilmar Cheese Company lowered its well water use by three percent per thousand units of production between 2011 and 2012.

Our work doesn't stop here. Equipping nearly 50,000 dairy farmers with the tools and information they need is a primary objective for the coming years. Small improvements on a single farm or in a single plant will add up to significant improvement for the industry as a whole, when multiplied by 50,000 dairy farms or 1,200 processing plants.

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THE VALDASO AGRI-ENVIRONMENTAL AGREEMENT IN CENTRAL ITALY

Francesco Vanni and Silvia Coderoni

6

SUMMARY

The Valdaso agri-environmental agreement has been developed in Central Italy as a result of farmers' collective action aimed at reducing the negative environmental impacts of intensive fruit production. The agreement was financed through a package of measures of the Regional Rural Development Programme.

BACKGROUND

According to the OECD methodology, based on resident population density, Marche is classified as a 'significantly rural' region. At the same time, only two percent of the regional value added derives from agricultural production (slightly above the national average). The regional industrialization process, supported by a high propensity to export, has led to the achievement of high standards of welfare in terms of GDP and employment rates. The majority of agricultural activities are located along the hills, while the coast is highly urbanized. The main agricultural products are cereals, vegetables, animal products, and grapes. The agricultural area represents 3.7 percent of Italy and farm holdings 2.8 percent. The average size of holdings (11 hectares) is above the national average (8 hectares). The case study presented here was developed in the Valdaso area (Aso Valley), a territory alongside the boundary between Ascoli Piceno and Fermo provinces that follows the path of the Aso River. Valdaso is a well-preserved valley with a very attractive landscape, but the local environment has suffered from various types of anthropogenic pressure, especially

Location

Marche region, Italy

Timeline

5 to 7 years

Land Use

permanent crops

Partners

regional and provincial government, farmers' associations, agricultural advisory center, private companies

Role of Government

regulator and funder

that derived from intensive agricultural production. Local agriculture is highly specialized in fruit production (peaches, plums, apples, and pears) and the orchards have been traditionally cultivated with a high use of chemical inputs, with negative environmental effects such as water and air pollution and loss of soil fertility.

EVOLUTION OF THE INITIATIVE

Over the past decade, local communities and local farmers in the Valdaso area have demonstrated an increasing awareness of the negative environmental impacts of the local farming system. As a result of this, in 2007, a small group of farmers (allied in a private association called Nuova Agricoltura) started a grassroots initiative with the objective of promoting the adoption of more sustainable farming practices on a territorial scale.

This initiative was supported by the

regional and provincial governments, which settled and implemented a specific agri-environmental agreement (AEA), financed by the Regional Rural Development Programme (RDP). As prescribed by the regional RDP, the area covered by this AEA should be an unbroken piece of land of at least 1,000 hectares and the agricultural area cultivated with fruit trees (peach, plum, apple, and pear) must represent at least 5 percent of this area.

The Valdaso AEA was designed to protect the soil and water from pesticide and nitrate pollution at the river-catchment level, through methods of production with a low environmental impact. The main goal of the agreement was setting environmental standards that went beyond the existing rules and regulations. The agreement established specific targets to be achieved in a period from five to seven years, such as a reduction of 30 percent in macronutrients (nitrogen, phosphorus, and potassium) used in the territory and the substitution of agrochemical inputs, characterized by acute or chronic toxicity, by 90 percent and 85 percent, respectively. To achieve these results, the AEA was structured as an integrated package of measures of the regional RDP, with the aim of financing a set of initiatives that could support the adoption of more sustainable agricultural practices at the territorial level.

The package of measures comprises a set of agri-environmental schemes, including integrated pest management (IPM) techniques, organic farming, and soil protection measures, as well as specific financial support for training activities and information actions. The capacity-building scheme associated with the agri-environmental schemes, articulated in farm visits and technical workshops, was included in the AEA with two main objectives—to raise farmers' awareness of the impacts of different agricultural practices on natural resources, and spread the adoption of

innovative and sustainable farming practices. Local farmers showed a particular interest in advanced IPM techniques, and especially in mating disruption, a crop protection strategy based on the use of synthesized sex pheromones to disrupt the reproductive cycle of insects.

At the beginning of the project development, in 2007, a small group of farmers associated with Nuova Agricoltura started to experiment with mating disruption, obtaining good results in terms of both productivity and a healthier environment. Since mating disruption is effective only when a large piece of unbroken land is involved, these pioneer farmers started to involve an increasing number of their neighbors, with a sort of 'domino effect' at the territorial level that brought a large number of farmers to join the agreement. During the first year of the agreement (2009), 82 farms were involved, corresponding to 257 hectares cultivated with IPM techniques. In the following years, other farmers joined the AEA, and, at the beginning of 2012, about 100 farmers were involved, corresponding to more than 560 hectares cultivated with advanced IPM techniques and 270 hectares of orchards with green cover.

These numbers were achieved as a result of a coordinated effort of a broad range of both public and private stakeholders, not only during the development of the agreement but also in managing the technical and administrative tasks.

The high number of farmers involved is the result of the effectiveness of the techniques proposed and the commitment of farmers from Nuova Agricoltura, who were already testing IPM techniques on their farms and realized that this type of technique implied that some level of farm aggregation would be more effective. This aggregation was pursued in collaboration with ASSAM (Agenzia Servizi Settore Agroalimentare delle Marche), which is the government agricultural advisory agency

of the Marche region, and especially thanks to a local adviser (project leader), who has been recognized as one of the key drivers of the development of this collective agri-environmental action. The bottom-up approach experienced through the activities of Nuova Agricoltura and the ASSAM project leader has been supported and coordinated by two provincial authorities that acted as promoters and definers of the agreement, by encouraging the regional government to design and implement a mix of policy measures targeted to local needs. The regional government acted as a regulator and co-funder (together with the EU), since it agreed on the adequate operational rules and the specific environmental goals to be included in the RDP, after the approval of the European Commission.

ASSAM played a central role in the co-creation of the agreement, not only in the development phase but also in the implementing phase, by giving advice about IPM techniques and for the development and transmission of new knowledge among farmers. In some cases, the technical assistance provided by ASSAM was integrated with the advice provided by some companies specialized in crop protection products, which were increasingly interested in commercializing products for IPM and especially for mating disruption. This interest is also due to the recent EU directive on the sustainable use of pesticides (Directive 2009/128/EC), which aims at reducing the risks to and impacts on human health and the environment related to the use of pesticides by reducing the number of permitted chemical products for crop protection and by promoting the use of alternative pest management methods. Among the other actors involved in the management of the AEA, professional farmers' organizations provided some support, especially concerning the administrative tasks (farmers' files and applications).

The adoption of crop protection strategies based on natural pheromones in place of chemical products by a large number of local farmers reduced to a large extent the sources of pollution and the negative environmental impacts of local agriculture. Unfortunately, these impacts have not been measured yet, since the ecological processes involved would result in positive environmental effects (reduction of air and water pollution) only in the medium to long term. This underpins the main limitations of control and monitoring mechanisms of the current agri-environmental schemes adopted in Europe, which in many cases fail to evaluate the real environmental effects of policy measures, especially when complex and multidimensional strategies are implemented.

On the other hand, the monitoring of the AEA in terms of health risks brought about significant impacts. Indeed, the ASSAM agrochemical center carried out chemical analysis of some samples of fruits cultivated with both conventional and IPM techniques. The results demonstrated that the fruits produced by farmers adhering to the AEA had much lower residues of pesticides than the fruits produced on farms that did not participate in this agreement. These results were presented in an open meeting, which was very successful because it showed farmers the good results obtained with IPM techniques, making farmers aware of the substantial results of their commitment. The importance of this meeting has been twofold—it improved farmers' awareness and understanding of the effects of the practice adopted and it showed farmers (and citizens) who did not participate in the agreement the important results obtained with the changed techniques, in terms of both crop losses and residues.

In this regard, a very important factor of success was the inclusion of this AEA in the regional strategy for food labeling called

QM—Qualità garantita dalle Marche (Guaranteed quality of the Marche region). The product certified as QM is peaches from Valdaso, and this strategy is becoming a crucial tool for local farmers to enhance and valorize the innovation of the agreement in the supply chain, since peach producers through this label have the opportunity to communicate to consumers their collective commitment to the environment, thus enhancing the reputation and trust of local communities toward their production practices.

The case of the Valdaso AEA sheds light on the governance mechanisms necessary to implement collective agri-environmental strategies. This figure summarizes the evolution of the AEA and the private and public actors involved. The development of the project (Phase 1) and its implementation (Phase 4) are based on shared responsibility and co-management of the AEA among farmers, farmer associations, and the government advisory center (ASSAM), while the design and the coordination of policy tools (Phases 2 and 3) is ensured by the complementary efforts of two different tiers of local governments (provincial and regional ones).

ANALYSIS AND LESSONS LEARNED

The Valdaso AEA represents an innovative approach to agri-environmental schemes. Indeed, unlike the majority of schemes adopted in this area the reduction in the environmental impacts of commercial agriculture has been addressed at a landscape scale, through innovative policy tools aimed at supporting grassroots collective action. The key factors that have determined the success of this agreement are (1) the characteristics of the local farming system, (2) the proactive engagement of farmers in the definition and implementation of the agreement, and (3) effective institutional support for the farmers' collective action.

The characteristics of the local farming system have been very important because the agreement was implemented in a delimited geographic area characterized by well-defined and homogeneous characteristics of the agricultural sector: intensive farming, medium-size farms, and specialization in fruit production. These prerequisites have facilitated both the interaction among local farmers who were experiencing similar problems and the widespread adoption of the advanced IPM techniques, by ensuring their effectiveness.

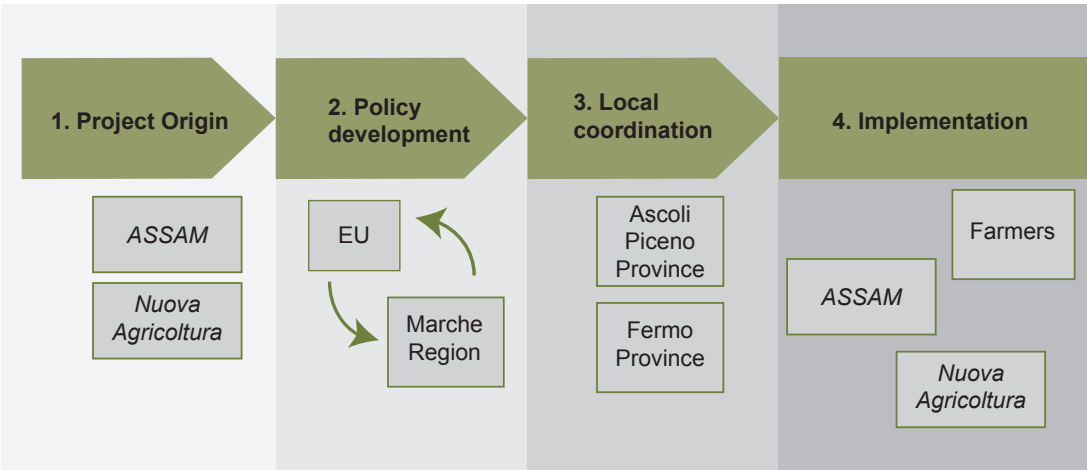


Figure 1. The actors involved in the different phases of the AEA.

In terms of engagement of farmers in the initiative, it is necessary to highlight the important role of the small group of highly motivated farmers (associated in Nuova Agricoltura) and the crucial role of the project leader, who ensured the required bridge between farmers and local institutions, by setting both the technical and administrative requirements for the collective adoption of agri-environmental schemes. The most reluctant farmers were persuaded by the most motivated farmers of Nuova Agricoltura but also by the efficacy of the new farming practices adopted, since in many cases local farmers were already looking for alternative methods of cultivation, having observed increasing resistance of pathogens to conventional crop protection products, resulting in higher crop losses.

Finally, local institutions ensured effective support to collective action through an innovative strategy aimed at pursuing multiple objectives: an integrated suite of measures was implemented to increase the provision of agri-environmental public goods but also for reframing farmers' behavior, attitudes, and knowledge through a set of capacity-building initiatives and learning opportunities.

This agreement has certainly provided a good opportunity to increase capacity building within local institutions, since it allowed them to experiment with a new approach in designing and delivering rural development strategies. At the same time, in many cases, the problems such as the division of the area of the agreement into two different provinces and the lack of authority of provincial administrations on agriculture resulted in poor communication and valorization of the results, and some farmers participating in the agreement did not feel adequately supported and informed by the local institutions. Other barriers experienced in the agreement were the typical problems of collective action,

such as higher transaction costs and the presence of free-riding behavior.

Regarding the problem of transaction costs, some of the administrative, coordination, and management costs were not fully financed through the RDP measures. By contrast, specific funding for the initial capacity-building process as well as for the coordination, management, and group activities should have been provided in order to increase the scope and the effectiveness of the agreement. At the same time, it should be recognized that this problem in Valdaso was quite efficiently addressed thanks to the relations of trust and reciprocity among the majority of farmers; the social capital deriving from this collective action reduced the transaction costs for local institutions, such as the costs of identifying relevant stakeholders, gathering information, and enforcing sanctions.

Although the results of the Valdaso AEA are the outcome of the particular mix of environmental, social, and institutional arrangements of the territory, some lessons can be learned from the innovative elements that characterized this approach, which be useful for scaling up the project in a broader context. These innovations cover different aspects, ranging from the knowledge and innovation dimensions to the collective action dynamics and, above all, to the policy dimension.

Knowledge and Innovation

- **Information exchanges and social learning among farmers are key issues in addressing environmental pollution deriving from commercial agriculture.** The social learning processes generated by the agreement were central to the success of this collective action to a great extent, from the adoption of the IPM techniques to the dissemination of such techniques to other farmers.
- **The knowledge of local farmers should be better integrated into policy**

instruments. The case study described here shows clearly how effective policy tools can be implemented through the direct involvement of farmers, by translating their local knowledge and their willingness to increase the sustainability of their farming practices into operational projects with specific environmental targets to be reached at a territorial scale.

- **Public advisory agencies play a key role in favoring the dissemination of knowledge related to environmental issues.** In Valdaso, ASSAM increased the environmental awareness and knowledge of farmers involved in the agreement and this was recognized as a key factor for the success of the initiative. Indeed, the advisory activities provided by this public body were particularly appreciated in a context in which technical assistance on the farm has been traditionally provided by advisers working for private companies. The ‘public’ and ‘disinterested’ advice by ASSAM was perceived by local stakeholders as crucial to obtaining advice on sustainable agricultural practices coherent with the environmental objectives pursued through the AEA.
- **The knowledge and learning dimensions should be better integrated into the agri-environmental schemes.** The case of Valdaso shows that the training activities related to the adoption of IPM techniques were particularly effective in increasing the awareness of local farmers regarding the environmental problems of the area, as well as in moving away from the traditional top-down approach to technical assistance in the territory.

Collective Action

- **Grassroots collective action for environmental purposes should be adequately financed and supported by local institutions.** The case of the

Valdaso AEA shows that collective action can play a significant role in controlling negative externalities from agriculture, especially if it is effectively supported by local institutions.

- **The success of collective agri-environmental strategies is highly dependent on the governance mechanisms.** The success of the Valdaso AEA is due to the coordinated and complementary efforts of a broad set of rural stakeholders (from local public authorities to private actors and farmers) that were able to adopt a coordinated strategy based on shared responsibility and co-management among private and public actors.
- **Strong leadership can play an important role in stimulating collective action.** In the case study, the ASSAM project leader played a key role by enhancing farmers’ confidence regarding the possibilities to undertake collective action for adopting sustainable farming practices at the territorial level.

Policy Instruments

- **The reduction in environmental impacts of commercial agriculture can be better addressed through the engagement of a range of local stakeholders in the design process of the agri-environmental strategies.** This case shows that the early involvement of key local (public and private) actors is an important factor for increasing the effectiveness of agri-environmental policies, since this allows designing measures more tailored to local needs and, above all, with effective environmental outcomes.
- **Better environmental outcomes can be achieved through integrated policy strategies.** The main policy innovation of the AEA is related to the package of RDP measures, which was able to take into account the technical requirements for the advanced IPM techniques and also the main requirements of the local

farmers in terms of advisory activities, learning, and networking.

- **Local public bodies and institutions can be key promoters and coordinators of specific projects related to decreasing the environmental impacts of agriculture.** The case shows the potential benefits associated with devolving power and responsibilities to local entities. Although the majority of European and national policies implemented for environmental purposes focus on administrative borders and are not tailored to specific territories, the Valdaso AEA shows how a sub-regional level of implementation facilitated effective coordination among local stakeholders, with higher environmental and socioeconomic benefits.
- **The adoption of marketing strategies and specific labels integrated with conventional policy tools can provide a relevant added value to environmental strategies.** The adoption of the QM label for peach producers is a very interesting example of how to achieve joint environmental and economic results.

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MANY POLICIES, FEW RESULTS: WHY SUSTAINABLE AGRICULTURE REMAINS ELUSIVE IN PUNJAB

Rasheed Sulaiman

7

SUMMARY

The success of Punjab's green revolution has contributed to severe environmental challenges that currently threaten its agriculture. Regulatory and technological initiatives to address these challenges do not yet show results, mainly because of the lack of comprehensive measures to address the wide range of institutional and policy changes required among different organizations.

BACKGROUND

Punjab, located in the Indo-Gangetic Plains in northern India, is the main food bowl of India. It contributes more than 10 percent of national rice production and more than 20 percent of national wheat production. Nearly 40 percent of the wheat and 60 percent of the rice that buffer the nation's central pool for maintaining food stocks and operating the public distribution system for the poor are contributed by Punjab (Perveen et al., 2012). Agriculture is dominated by rice and wheat, which now cover more than three-quarters of the cropped area. More than 97 percent of the cropped area is irrigated, of which 70 percent is irrigated by tube wells. The state has one of the highest cropping intensities (189.4 percent). Punjab also leads the country in fertilizer use and tractor density.

However, the sustainability of rice-wheat farming in Punjab is under threat. Groundwater levels have been falling at a rate of almost one-quarter meter per year because of excessive drawing of groundwater for irrigation. The average drop in the water table in the central districts of

Location

Punjab, India

Timeline

2006 to 2013

Land Use

irrigated paddy-wheat rotation

Partners

mainly government

Role of Government

regulator, promoter, funder, enabler

Punjab, which was just 25 centimeters per annum during 1992–97, reached the alarming level of more than 80 centimeters per annum during 2001–07 (Kaur, 2008). There were only 192,000 shallow tube wells in the state during 1970, which increased to 600,000 in 1980, and now the state has more than 1 million tube wells. Declining water tables have forced farmers to invest heavily in deepening the wells and installing submersible pumps. This has led to declining farm incomes, increasing rural indebtedness, and higher consumption of electricity to pump water from deeper levels, resulting in a huge burden on the state exchequer as it provides free power to tube wells for irrigation.

EVOLUTION OF INITIATIVE

Traditionally, farmers in Punjab had followed the maize-wheat or sugarcane-maize-wheat cropping pattern but, during the last four decades, they have shifted to the wheat-rice cropping pattern,

thereby leading to increased demand for irrigation water. Rice is currently grown on 2.74 million hectares and is largely dependent on groundwater resources, covering about 67 percent of the net sown area, which is irrigated. In addition to several government subsidies that support water-intensive cropping, pumping technology facilitated by subsidized or free power is responsible for the rapid expansion and overexploitation of groundwater. In Punjab, power for agriculture was totally free from 1997 to 2002 and from 2005 onward.

The government of Punjab appointed an expert committee in 1985 to diagnose the problem of excessive groundwater irrigation and suggest suitable remedial measures. This committee recommended diversification of Punjab agriculture away from the existing wheat-paddy cropping toward the production of less water-intensive but more remunerative crops such as fruits, vegetables, and pulses—not only to increase income but also to reduce environmental degradation for the long-term sustainability of agriculture and water resources in the state (GoP, 1986). But, because of the economic and institutional advantages enjoyed by wheat and rice, government efforts to promote crop diversification since 1985 have largely been futile. Diversification initiatives attempted through contract farming with private agribusiness failed for a number of technological and marketing reasons (Perveen et al., 2012). After this experience, a large majority of the farmers were unwilling to enter into contract farming arrangements again (Dhaliwal et al., 2003).

In Central Punjab, the rate of decline in the water table accelerated to 42 centimeters per year from 1997 to 2002 to a staggering 75 centimeters during 2002–06 (Singh, 2006). This has been mainly due to the cultivation of paddy and partly due to its early transplanting (before mid-June), which means severe withdrawal of groundwater

as the monsoon is still far away and the temperature is very high and the evapotranspiration rate is high. One of the key steps that could reduce the water table decline is delayed transplanting in paddy. Research has established that transplantation of rice after June 15 reduces water use by 42 centimeters and 23 centimeters when compared with transplanting on May 15 and 31, respectively (Singh, 2009).

In 2006, the state government tried to influence the date of paddy transplanting by changing the date on which free electricity was diverted to the farm sector for operating mechanized tube wells for groundwater extraction. This date was pushed to June 10, thereby reducing the amount of intensive watering that the crop could receive during its production cycle. The delayed date was made mandatory in 2008 via an ordinance and it prevented farmers from sowing paddy nursery before May 10 and transplanting paddy before June 10. This ordinance was changed to an Act in 2009. The main purpose of this law (the Punjab Preservation of Subsoil Water Act, 2009) was to preserve groundwater and the law created the authority to destroy, at farmers' expense, paddy sowed or transplanted early and give a penalty of approximately US\$150 per month per hectare of land in violation of the law (GoP, 2009).

Though there were doubts initially about its impact on paddy yields and the difficulties in enforcing this act, farmers soon realized that the delay in planting paddy had no effect on its yield, and currently paddy is not transplanted before June 10 in most places across the state. Although Singh (2009) noted the positive impacts on water balance and savings from electricity consumption that could accrue due to the implementation of the Act, these claims have been contested by Sekhri (2012), who noted that the annual groundwater level worsened in rice growing areas after the policy change. It is possible that farmers

responded to the policy by increasing the number of irrigations applied or by using more water per irrigation after the mid-June transplanting.

Singh (2013) noted that, against the recommended time of transplanting in the second week of June, about 25 percent of the rice area in Punjab is still transplanted in May. The reasons advocated by the farmers were that the early rice crop escapes pests and diseases and has a longer growing period, resulting in higher yields. However, the policy of late procurement of paddy by the state agencies has recently helped to restrict the early transplanting to some extent.

Considering the importance of other policy instruments to arrest the falling groundwater levels and soil health, the government of Punjab decided to promote farm machinery, such as zero-till drills, the rotavator, laser leveler, and happy seeder to conserve soil and water. This farm machinery is extremely helpful in conserving groundwater, soil, and the environment. For instance, laser land leveling helps save 25 to 35 percent of water and enhances crop yield (25 to 30 percent) and input-use efficiency. Zero tillage can decrease the time consumed in crop planting, thus enabling timely sowing and savings of fuel (US\$250 per hectare) and ultimately giving more yield and profit (PDFSR, 2011). The happy seeder can help stop rice straw burning and help improve soil fertility by incorporating organic matter in the soil. The rotavator can easily mix the residues of the last crop once the farm is filled with them.

The Department of Agriculture has been organizing demonstrations and trainings to promote this farm machinery. However, this equipment is generally expensive and it is difficult for individual farmers, especially small and marginal farmers, to purchase it without any financial support from the government. The government is

providing a 50 percent subsidy to farmers and cooperative societies to purchase this equipment. After 2010, the purchase and use of this farm equipment has increased. However, the lack of tractors with higher capacity (to mount these machines) and unavailability of skilled operators constrain their large-scale adoption. For instance, although tractors with 50 horsepower or more are needed for running happy seeders, most farmers have only 35 horsepower tractors. Similarly, in the case of the laser land leveler, the high cost of the equipment and lack of an adequate number of skilled operators to set/adjust the laser setting and operate the tractor constrain their wider use. As this machinery is expensive and is needed for only a limited number of days in a year, the government is assisting in setting up custom hiring services through Primary Agricultural Cooperative Societies and private entrepreneurs. So far, 1,285 such centers have been set up in the state (GoP, 2013).

ANALYSIS AND LESSONS LEARNED

Sustainability of Punjab agriculture is critical for India's food security. Although the production and productivity of paddy and wheat have gone up in this region over the last four decades, this has created an environmental crisis in Punjab. The state had to intervene to arrest the declining soil health and conserve water. Earlier attempts to promote diversification of agriculture failed because of a lack of assured market and absence of a favorable price regime. Moreover, the guaranteed high return and assured procurement of wheat and rice by the government have ensured continuity of the rice-wheat rotation.

The government of Punjab chose to adopt the legislative route as other means of discouraging early sowing and transplanting (such as advocacy) failed. The Punjab Preservation of Subsoil Water Act was implemented specifically to ensure compliance

with the government policy of delayed sowing and transplanting. With the Act in place, farmers were forced to comply and over a period of time they realized the advantages of delayed planting, especially as it slowed down the rate of depletion of subsoil water and also gave them savings in the cost of production (because of reduced water and power use to draw groundwater). However, the new evidence clearly revealed that this approach hasn't fully resulted in the desired outcome. The water tables continue to drop at an alarming rate; 79 percent of the groundwater assessment divisions (blocks) in the state are now considered overexploited and critical, with extraction exceeding the supply (CGWB, 2010).

Since 2010, the government of Punjab has been actively engaged in promoting new farm machinery that conserves soil and water (laser leveler, happy seeder, zero-till seed-cum-fertilizer drill, rotavator) through training, demonstrations, and financial incentives for its purchase. The adoption of such machinery will help improve water-use efficiency and the yield of crops as well as help reduce burning of paddy straw and improve the environment and soil health in the long run. But, the success of this policy essentially depends on how far custom hiring of farm machinery can be promoted in the state and how the capacity for operating this machinery is enhanced.

Although these legislative, technical, and financial instruments are necessary to reduce the use of groundwater, there is an increasing realization that these are not sufficient to meet the challenge. Many believe that, without a significant reduction in area under paddy, the sustainability issues around Punjab agriculture are not going to be solved. The Punjab State Farmers Commission recently published a draft new agricultural policy (2013) that envisages substantial crop diversification from paddy and wheat staples. The policy aims to decrease the area under paddy

from the current 2.8 million hectares to 1.6 million hectares (recommended by Punjab Agricultural University as the maximum the state can grow without further affecting groundwater levels) in the next 5 to 7 years. It is not clear how this is going to be achieved as this would involve realignment of several policies with respect to input use (including water and agrochemicals), cropping pattern, procurement, marketing, and prices that finally determine the sustainability and profitability of farming in Punjab.

One of the major lessons emerging from this case is the need for simultaneous changes/revisions in a range of institutions (rules, norms, habits, and practices) and policies to achieve sustainability. Addressing environmental degradation and the promotion of sustainable agriculture involves a change in behavioral practices of a number of different organizations related to production (land use pattern and cultivation of alternate crops): research and extension (on resource-conserving technologies), input use (standards and regulations, including payment based on quantum of use), marketing, and consumer preference. These would therefore require simultaneous changes in institutions and policies across the wide range of organizations. Other policies related to conservation of rainwater such as water harvesting and infrastructure that could support the promotion of new value chains also need to be in place to achieve significant and long-lasting impacts. All these would involve considerable re-alignment of different policies so that together these policies would be effective. Mechanisms to ensure simultaneous institutional and policy changes in different themes related to sustainable agriculture seem to be lacking at the moment in Punjab.

The second major lesson is the importance of policy learning—a structured and conscious change in thinking about

a specific policy issue based on collective learning from its implementation—which seems to be currently lacking here. This involves a continuous process of monitoring, learning, and evaluating policies and their implementation for a number of competing and complementary policies that will help the policy actors quickly respond to emerging challenges and opportunities. Mechanisms to promote policy learning through evaluations and sharing of results and learning from implementing policy changes have to be created at different levels so that the system can quickly and effectively respond to the rapidly evolving agricultural context. Beyond ad hoc consultations that often happen among the wide range of stakeholders, a learning platform for regular interactions for joint design, implementation, reviewing, and learning among the different stakeholders needs to be put in place to promote policy learning.

Third, the case clearly illustrates the continuing role of the state as an enabler, regulator, funder, and promoter in bringing more sustainable management practices in commercial agriculture. Moreover, several important public institutions involved in technology development, technology promotion, monitoring of soil and water health, promotion and development of rural infrastructure, marketing, and law enforcement have to play an important role in promoting sustainable and profitable food production. At the same time, the state alone won't be able to tackle the issue of sustainable agriculture. It needs collaboration among several actors from the public, private, and civil society sector and therefore would require measures to build trust and improve capacity to manage these arrangements.

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RESEARCH AND EDUCATION TO ADVANCE CONSERVATION AND HABITAT, USA

8

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SUMMARY

REACH is a producer-driven, hands-on delivery vehicle that provides coordination and support for documenting the benefits of conservation efforts in natural resources and agriculture. REACH provides scientifically defensible information to support efforts that meet the resource needs of landowners and producers while promoting sustainable conservation practices in production agriculture.

BACKGROUND

REACH operates within the state of Mississippi in the United States. Common features of this region are (1) alluvial soils that are inherently variable in texture, (2) temperate winters with hot summers (frequently reaching highs in excess of 35 °C), with (3) high humidity common in May through September, and (4) average annual rainfall of approximately 147 cm. Agriculture, at US\$7.51 billion, is Mississippi's top industry, employing approximately 29 percent of the state's workforce in some capacity. Mississippi has more than 42,000 farms and more than 4.5 million hectares of farmland, mixed between small and large operations. Major field crops grown are corn (*Zea mays*), soybean (*Glycine max*), cotton (*Gossypium hirsutum*), and wheat (*Triticum aestivum*), as well as rice (*Oryza sativa*) in the heavier clay soils, with much area requiring irrigation water pulled from the Mississippi alluvial aquifer. The state is also a major producer of poultry, livestock, forestry, and aquaculture products.

Most of the row-crop agriculture in the state is located in the Delta region, an

Location

Mississippi, United States

Timeline

2012 to (at least) 2016

Land Use

commodity production (all cropping systems)

Partners

state, federal government, university, private sector, NGOs

Role of Government

enabler

alluvial plain along the Mississippi River in the northwest portion of the state; however, all areas of the state have some form of agriculture. The intensive nature of these production systems and the proximity of the Delta region to the Mississippi River make non-point-source pollution from agricultural runoff a significant environmental management challenge for this region. Researchers working with the U.S. Geological Survey included the state of Mississippi among nine states considered to have the highest delivered yield of nitrogen and phosphorus to the Gulf of Mexico. Heavy use of agricultural fertilizers has been linked to a seasonal Gulf of Mexico hypoxic zone, resulting in a call by multiple state and federal agencies for best management practices (BMPs) that mitigate the impact production agriculture has on the nation's water resources. As populations increase, the intensity of agriculture is expected to

rise in tandem, indicating that this problem will continue unless producers enact protective measures.

EVOLUTION OF THE INITIATIVE

In the wake of a growing global population that will increase demand for food and fiber, the agricultural industry in Mississippi will look to intensify production, putting additional pressure on the state's soil and water resources. Natural resource concerns, particularly water resources, in Mississippi were the motivation for starting REACH. Significant recent investments in landscape improvements by the federal government and producers, through cost-share programs for resource conservation (>US\$30 million), warrant increased research, supporting the efficacy of conservation practices. Although government financial assistance is offered in the U.S., no central program at the farm level documents the many benefits (social, ecological, and economic) accrued by these conservation efforts. Nor does a central program bring the cooperators from research, university extension, and state and federal agencies together to enhance landscape stewardship. Through education, outreach, and research, REACH hopes to elucidate how conservation practices can reduce the anticipated impacts on Mississippi's resources while congruently allowing for sustainable intensification of agriculture. Currently, under U.S. law, non-point-source pollution (i.e., nutrient loading from runoff) is not regulated, but movement to implement reduction strategies have begun. REACH wants to enable producers to showcase and assign value to their conservation efforts.

The initial concept and foundation behind REACH started well before it was formally established as a program in Mississippi. A group of interested stakeholders from state and federal agencies and non-governmental organizations (NGOs) as well

as landowners were led by the Mississippi Department of Environmental Quality (MDEQ, a state agency) and Delta F.A.R.M. (Farmers Advocating Resource Management, an NGO comprising primarily producers) to create the very first nutrient reduction strategy in the Mississippi River Basin. The strategy clearly outlined a path forward to dealing with, and improving, nutrient management in agriculture. After implementation of the strategy, members from Delta F.A.R.M., The Nature Conservancy (an NGO), and Mississippi State University (MSU, a public state-funded Land Grant University) saw the need to move the strategy to the next level.

Founding stakeholders were driven to evaluate the science behind conservation practices, and were encouraged by producers to proceed along this course. Key issues the group considered related to how members would translate the benefits of conservation to their farmer constituents, how they could present their conservation results to the appropriate policy makers in local, state, and national governments, and how they could start measuring results at a landscape level. REACH was created to answer these questions and more. One principle of REACH that speaks to both producers and policy makers is that REACH evaluates issues with economic answers. Although the analysis of data supplies measures of statistical significance to REACH researchers, what is often communicated to producers and policy makers is dollars saved or spent. REACH has already been able to provide answers to stakeholders related to economic savings related to water re-use. Additionally, REACH has been able to provide answers related to the effectiveness in reduced nutrient concentrations for many BMPs so that cost-share partners can evaluate the benefit to the environment of their investment.

From the outset, REACH sought inclusivity of partners. The program in its infancy

had public meetings across the state inviting people to listening sessions. The sessions were designed to obtain input and buy-in to the program. As the program began to coalesce, MSU took the lead on the program. Today, REACH is a university-led, innovative, grassroots collaborative program, whose core includes various units at MSU (MSU Extension Service, Mississippi Agricultural and Forestry Experiment Station, Forest and Wildlife Research Center) and Delta F.A.R.M. REACH works with many natural resource concerns, but most notably with water pollution and conservation as they relate to agriculture.

The goal of REACH was to create a network of cooperative farms in Mississippi, with variable agricultural systems, degrees of conservation initiatives, and ecosystem monitoring to illustrate the success of conservation practice implementation. REACH and its collaborators collect data to quantify the contribution of conservation practices. This includes data on water quality, specifically nutrient and sediment in runoff, which is used to quantify BMP efficiencies. Additionally, data are collected on the quality and quantity of water available for re-use in on-farm storage reservoirs, a practice that addresses both of Mississippi's key concerns with regard to water resources. Since the program is producer driven, the goals focus on reaching producers.

REACH was established in May 2012, and the goals outlined were to enroll ten REACH producers by November 2013, and by November 2016 have enrolled 20,000 hectares. In its first year of existence, REACH worked with and enrolled 41 farms, encompassing more than 51,000 hectares. These farms provide producers, conservationists, educators, and policy makers with key information to better implement and advocate management practices oriented toward various local and regional objectives (e.g., targeted nutrient reductions, agricultural

production system improvements, habitat restoration). Information is disseminated through standard scientific venues such as conferences and journal publications. It is also disseminated through outreach materials such as videos, flyers, newsletters, social media, and listservs of REACH and its collaborators. Additionally, REACH facilitates field demonstrations and grower meetings with assistance from the MSU Extension Service, collaborating NGOs, government agencies, and REACH producers.

REACH also strives to be a liaison between government agencies, NGOs, research professionals, landowners, and producers. Under the REACH program, the government serves as a fiscal and financial instrument via economic incentives (i.e., incentive, cost-share, and easement programs) made available to producers for BMP implementation and grants to research professionals for research that enhances knowledge about the efficacy of the BMPs. The government fills the roles of regulator and funder. The government is a regulator when it establishes levels for allowable pollution, and a funder when it provides the aforementioned subsidies and grants to producers and researchers. NGOs and researchers provide the capability-enhancement instruments through technical assistance to producers, research and development on existing and new BMPs, and technology transfer to producers en masse. NGOs and the REACH program fill the roles of promoter and enabler. Both are promoters by recruiting producers to the program, monitoring their progress, and disseminating research findings back to producers to encourage their use of BMPs. Both also serve as enablers by providing producers with technical assistance on implementation. Ultimately, REACH is the engine that brings government and NGOs together into one system that serves producers and provides these services.

REACH continues to grow with support from MSU as well as other partner agencies. Although government assistance is provided by the U.S. Department of Agriculture Natural Resource Conservation Service (USDA-NRCS) to implement BMPs, many producers are unaware of many of the BMPs that exist, eligibility requirements, and the application process for government incentive programs for which they are qualified. REACH closes the loop between government and producers, helping them to adopt conservation practices that enhance their production and, in turn, providing the government with scientifically defensible data that evaluate the BMPs for which they provide hundreds of millions of dollars in assistance. Producers have been implementing practices that control drainage and capture surface runoff, but little attention has been given to quantifying the nutrient-loading reductions of these practices.

REACH also uses the success stories of producers that have adopted these practices to help promote conservation of natural resources. This promotion technique has helped garner producer interest and support for government programs, despite historical resistance to government involvement in farming practices in the Mississippi Delta. For example, REACH has been able to quantify decreases in nutrient concentration leaving production fields due to these practices by examining pre-implementation and post-implementation data for several REACH farms. REACH has also been able to demonstrate the total volume of surface water runoff captured and reused by several production operations and attest to the quality of the water being reused. At the same time, REACH helps promote the success of marrying conservation and agriculture, changing the public view of producers from polluters of the nation's waters to protectors of the nation's most precious resources—food, fiber, and water.

ANALYSIS AND LESSONS LEARNED

REACH is unique in several ways. First, with traditional BMP implementation, producers must sacrifice production land to accommodate BMPs; this puts agriculture at odds with conservation. REACH shows that these are not competing systems, and BMPs can fit seamlessly into the agricultural landscape. Second, REACH is producer-driven, with REACH providing assistance that furthers producers' conservation goals while aiming to enhance farm productivity and profitability. REACH also provides scientifically defensible data of BMP efficacy on actual production fields. Ultimately, these factors culminate in REACH providing sound justification for government investment in conservation.

REACH has had numerous lessons learned in its short existence. First and foremost, its success comes from involving front-line stakeholders in championing the cause. Although its initial producers may have been the most progressive producers in their area, their experience and championship of the program have allowed it to trickle down to less progressive producers and brought them into the program as well. The success of REACH is due ultimately to its landowners and producers. It is their message that is important—not the program's. The program is merely a conduit to disseminate the success of these stakeholders and their stewardship. It has also been fortunate to have charismatic leaders in the community advocate for REACH. Second, government agencies (USDA-NRCS and MDEQ) have recognized the need for documenting successes of investment. Documenting successes is not only good to show improvement and progress, but this also validates the investment, and helps these government agencies justify the continuation of their related programs to budget committees and taxpayers. Documentation also provides

critical information for regulatory instruments that can be adaptively managed in the light of new information.

Several approaches can be credited for REACH's success. The success of REACH lies in the hands of its producers. The willingness and want from the landowners and stakeholders of Mississippi to showcase their successes in conservation integration and profitable agriculture drive the program—they want their peers to see that it is possible to have both conservation and profitability. Additionally, the desire of its landowners and stakeholders to constantly want to improve their operations and make their operations more efficient translates into the adoption of a conservation mind-set. REACH focuses on one-on-one interaction. The success of REACH comes from the willingness to make it personal. Taking the time to listen to its landowners, listen to their needs, their concerns, and their desires, and then tailoring its work and delivery to those specific needs is a key reason why REACH is successful. It is a personalized, producer-driven program. REACH is also a partnership, not only with producers but also with a network of collaborators. REACH was born on a foundation of collaboration and it has continued that by expanding its roster of partners to 29 entities, including state and federal government agencies, private industry, and NGOs.

Furthermore, the REACH approach is innovative. As REACH moves through the 21st century, it is clear that, as new technology emerges and new generations enter into various roles, the means by which information is collected, analyzed, viewed, and ultimately disseminated needs to be cutting-edge, and, for producers who desire this level of technology, REACH strives to make it available. It is important to note, however, that this is not necessarily a requirement for participation in REACH. Many of the solutions offered to producers

are low-tech solutions, or are creative, engineered solutions that work with the situation in which producers operate, however limited it may be. REACH has recognized this from the outset and has constantly strived to be innovative in its approaches. Some examples follow:

- Data collected on-site are available online. Certain sites have a remote camera that is accessible to the producer and public to have real-time feedback on what is happening at the site. Real-time data feedback is often critical for decision making and this capability is warmly welcomed by producers.
- Information is disseminated in small, digestible quantities. REACH has adopted a stance that all the information can be delivered to stakeholders, agencies, and the public in videos less than 2 minutes in length. Anything longer and one loses audience participation because busy lifestyles don't allow time to sit and watch 5–10 minute-long videos. REACH keeps its messaging short, sharp, and to the point.
- Stakeholders are equal. REACH took the stance that it was created to serve commodity production in Mississippi—regardless of background, size, or type of cropping system. For this reason, its goals addressed both the number of producers and number of hectares. Smallholders were treated and provided with the same resources as large holders, because serving both populations satisfies REACH's goals.

Like any new program, REACH has had some challenges. Although it hasn't seen many limits to the enthusiasm with which the program has been embraced by stakeholders, it has experienced the standard challenge for any program, limitations on resources. Resources are vital for the success of the program. The tailoring approach of REACH can limit the broadness

of the program and serve as a bottleneck, but quality is favored over quantity as a program such as REACH is promoted by experience and word-of-mouth within the producer community and with stakeholders. REACH has been so successful because of the quality of the effort, which is key to the program's longevity. It is hoped there will be a point in the future, however, when the amount of research allows REACH to have enough information about key BMPs to provide stock standard solutions for producers, which will increase the scale of the program. As the program matures and proliferates, REACH must maintain and grow its resource base for program productivity and longevity.

REACH has also had to overcome a hurdle of skepticism from stakeholders. Often when articulating to a stakeholder what REACH is designed to do—which simply is help them in whatever they need help with as it relates to conservation—the response is often that the program sounds too good to be true. To combat this mindset, REACH uses its producers to sell the program. Instead of REACH program staff convincing producers of the merits of REACH, REACH shares contact information from consenting REACH producers with prospective individuals and says, “Don’t let us convince you, let your peer convince you.” In this way, REACH lets people who are its peers describe why they have decided to be REACH producers, and this approach has been extremely successful. Lastly, there are times when REACH may not be able to provide the right answers. Since REACH is a personalized program, sometimes a new problem occurs, and program staff lack the experience and expertise to assist a producer immediately. This is when those collaborative relationships are crucial. REACH relies on these partnerships to fill the knowledge gap and get producers the necessary answers to help them further their goals.

REACH is a unique program in its approach, but there is nothing particularly specific to the program that precludes its implementation elsewhere. The REACH model of producer-driven, producer-led can be adopted anywhere. The tailoring aspect of REACH requires a program only to meet personally with producers and collaboratively develop a conservation plan for their farm based on their individual concerns, goals, and needs. When people are willing, the program can exist. To replicate REACH, stakeholders would have to do the following:

1. Have a motivated staff to do the work. Implementing a program like this, which is tailored to individual stakeholders, is a lot of work, but effort is rewarded.
2. Make partnerships a priority. The more stakeholders, agencies, and individuals involved, the larger your constituency base, the larger your pool to draw expertise from, and the more likely you are to succeed.
3. Find key, influential landowners to be your champions. By identifying leaders in the production community and showcasing their efforts, what techniques they used, and how this benefited their production system, the more likely you are to garner support from agencies, overcome skepticism, and win allies.
4. Be passionate and enthusiastic. When the stakeholders you are trying to help understand that your mission is solely to help them in everything you can do, and individuals follow through with what they promise, the program will flourish.

ENVIRONMENTALLY-SOUND AND ECONOMICALLY-VIABLE AGRICULTURE THROUGH SMALL AND MARGINAL FARMERS' INSTITUTIONS IN ANDHRA PRADESH AND BIHAR, INDIA

9

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SUMMARY

The Community Managed Sustainable Agriculture (CMSA)¹ approach of Andhra Pradesh and the System of Crop Intensification (SCI)² approach of Bihar have facilitated an ecological approach to agriculture for more than two million small and marginal farmers.³ The key to the success of these initiatives has been the institutional arrangements among various stakeholders. These initiatives have sought to enhance agricultural profitability among small and marginal farmers while reducing the environmental footprint of agriculture.

BACKGROUND

This paper presents two case studies: the CMSA approach of Andhra Pradesh (AP) (now divided into Andhra Pradesh and Telangana states) and the SCI approach of Bihar. Both states are located in India's subtropical climatic region. These states are prone to drought and frequent river flooding. In AP, agriculture contributes 25

Location

Andhra Pradesh and Bihar states, India

Timeline

CMSA: 2005 to present; SCI: 2007 to present

Land Use

farming

Partners

CMSA: The Governments of Andhra Pradesh and Telangana, Communities, The World Bank, NGOs; SCI: The Government of Bihar, Communities, World Bank, NGOs

Role of Government

enabler, funder

1 Community Managed Sustainable Agriculture builds on non-pesticidal management and complements this process by adopting biological and agronomic soil fertility improvement measures that lead to reduced use of chemical fertilizers.

2 SCI is a low-cost, knowledge-intensive methodology of production, a mix of scientifically proven methods, indigenous knowledge, and better management of the soil, water, plants, and nutrients. The core principle of this methodology is to ensure adequate development of root systems to give the plants greater access to nutrients and water in the soil while also nurturing beneficial soil organisms.

3 Small farmers are defined as cultivators with a landholding of two hectares (five acres) or less. Marginal farmers are defined as cultivators with a landholding of one hectare or less (2.5 acres).

percent of gross state domestic product (GSDP) and provides employment to nearly 60 percent of the workforce. Similarly, agriculture is the backbone of Bihar's economy, accounting for nearly 42 percent of the state's domestic product and for 81 percent of the workforce (DoA, 2014). Agricultural productivity in Bihar greatly affects food security, as 88 percent of Bihar's poor depend on farming for their subsistence. Bihar's agricultural productivity is one of the lowest in India, and the productivity of smallholders is even lower than the state average (Behera et al., 2013; BRLPS, 2011).

Rice, wheat, corn (maize), pulses, and vegetables are the major crops in both states. Crop productivity is low because of

weather variability and limited access to inputs such as credit, information, good quality seeds, etc. Extension facilities are generally not customized for smallholder farmers. Further, they do not facilitate the implementation of environmental protection measures.

The following environmental risks are associated with agricultural production in AP and Bihar:

- Methane emissions from flood irrigation of paddy fields;
- Nitrates and phosphates, mainly from fertilizers, entering water bodies and stores, thus causing eutrophication, groundwater contamination, and damage to aquatic biodiversity;
- Excessive chemical fertilizers and pesticides entering into the food chain and damaging friendly insects. This also affects groundwater quality, leading to deterioration in environmental health; and
- Because agricultural fields and human habitats are located in close proximity to one another and share common water bodies, there is evidence of human and livestock health risk.

Since the mid to late 2000s, the state governments of AP and Bihar have been implementing CMSA and SCI with support from the World Bank. In AP, the government has supported the Society for Elimination of Rural Poverty (SERP), and in Bihar, the state government has supported the Bihar Rural Livelihoods Promotion Society (BRLPS). Known as *Jeevika*, this program develops and facilitates community institutions for the development of rural livelihoods. These constitute a four-tiered, federated institutional platform that is owned and supervised by communities. The tiers are self-help groups (SHGs) at the base, village organizations, then sub-district federations, and district federations. The main function of these institutions is

to develop livelihoods and reduce vulnerabilities of communities through collective action.

EVOLUTION OF THE INITIATIVES

In AP, farmers have long been engaged in input-intensive production of cash crops (e.g. cotton). Increased use of chemical fertilizers and pesticides has made agriculture unprofitable. Also, the unavailability of options for chemical fertilizers and pesticides led to their unregulated and excessive use. In AP, as much as 35 percent of farmers' total cultivation expenditure was spent on chemical fertilizer and pesticides alone. In the late nineties, the situation reached a crisis point when many farmers became heavily indebted. The crisis came into the public spotlight following a surge of farmer suicides (Vijay Kumar et al., 2009).

In 1995, the decline in agricultural profitability and increasing health risk to humans and livestock prompted some donor agencies and NGOs to launch initiatives aimed at increasing agricultural profitability while preventing and mitigating the environmental risks associated with chemical-dependent agricultural production. One initial effort was the promotion of non-pesticidal management (NPM) of agriculture by some NGOs, the most prominent being the NGO Centre for Sustainable Agriculture. NPM aimed to reduce cultivation costs and provide relief from debt by replacing pesticide application with ecologically-friendly, chemical-free farming. This has significantly reduced cultivation costs, the need for large amounts of credit, and consequent indebtedness (Vijay Kumar et al., 2009).

The CMSA approach replaces the use of chemical pesticides with a combination of physical and biological measures—including ecofriendly bio-pesticides—and complements this by adopting biological and agronomic soil fertility improvement measures that can lead to a reduced reliance

on chemical fertilizers. These transformational changes have been achieved without significantly reducing crop yields for the participating farmers and, indeed, enhancing their incomes as well as health (Vijay Kumar et al., 2009).

CMSA follows a decentralized extension approach to scaling-up sustainable agricultural practices. The decentralized extension agents are accountable to the communities where best-practicing farmers act as change agents. It is a knowledge-intensive approach, and the program is driven by frequent innovations of farmers and their 'research' efforts. Since the entire effort is based on local, natural, and renewable resources, a key by-product is that the farmers are performing valuable environmental services. Their actions help them adapt to climate change. Sometimes, farmers need new technologies or tools for spreading technologies in a short time. One such tool used is community video: 'Digital Libraries' (Gupta et al., 2014). In AP, the program has a management information system in place that captures farmers' group, farm, and household-level data through mobile phones and produces timely data analytics for community institutions and project managers to make targeted decisions.

Similarly, in Bihar, low productivity was common among smallholder and marginal farmers. SCI was introduced to increase productivity and reduce the intensity of usage of agricultural inputs. SCI uses a combination of approaches—a mix of scientifically proven methods, indigenous knowledge, and better management of soil, water, plants, and nutrients plus tools to ensure flexibility. The process starts with women self-help groups mobilizing farmers and helping formulate a village-level micro-plan based on each farmer's requirements. The micro-plan reflects farmers' choices of crop, the inputs, practices, or approaches the farmer wants to invest

in, and the requirements for financial and technical resources. These plans are aggregated at the village level to determine the content, scale, and resource requirements. This model is not only flexible and driven by local needs, but also it facilitates the transfer of peer learning and acts as a platform for experimentation.

The village resource person (VRP), selected and hired by the village organization, visits the plots of all interested farmers and identifies gaps in crop, soil, and water management. The findings of this assessment and the solutions to overcome these gaps are shared at the next SHG meetings. In addition, Farmer Field Schools (FFS) are organized by a VRP who identifies plots in the village that have successfully implemented SCI. These plots become a local platform for demonstration and experimentation of best practices and training. This is a good example of a closed-loop feedback mechanism suitable for small and marginal farmers.

Jeevika in collaboration with Digital Green trains members of local communities about group facilitation, videography, and basic video production. These videographers create digital content locally, highlighting both internal and external best practices. The videos are stored at the village level (and also uploaded on YouTube), creating a local and online digital library, and they are disseminated widely through a network of village resource people using low-cost pico-projectors (Gupta et al., 2014).

The implementation of CMSA and SCI has involved a wide range of partnerships, among NGOs, local government agencies, donors, and other financial agencies. In both AP and Bihar, NGOs offered initial guidance to community institutions by developing technical protocols and capacity building for these institutions. Partnerships with private firms helped in the marketing of pesticide-free and organic products and

providing market intelligence. Government agencies have also played a critical role in organic certification and marketing of organic products. In the last five years, there has been convergence with various social protection programs of the state and federal governments. These programs have helped CMSA in grounding rain fed sustainable agricultural activities, in the establishment of vegetable sheds for marketing products, and leveraging additional funding for land and water management.

State governments have been involved in funding CMSA and SCI and facilitating their various components. The main roles played by government agencies in the implementation of CMSA and SCI have been:

In AP:

- Providing land access to the poor;
- Supporting agricultural farms through allocating public expenditure (e.g., MGN-REGA-Telangana and MGNREGA-AP); and
- Investing in autonomous institutions to promote green agriculture.⁴

In Bihar:

- Defining strategy for SCI and organic agriculture and providing a road map for agriculture;
- Investing in BRLPS;
- Investing in community institutions; and
- Learning and scaling-up SCI through its own extension systems.

The Department of Agriculture, at the direction of the central government, has set up Agriculture Technology Management Agency (ATMA) units at the district

4 Green agriculture includes biophysical and bio-intensive technologies and approaches, including mulching, green manuring, system of crop intensification, composting, moisture retention, pesticide reduction, and introduction of bio-pesticides; climate-smart and environmentally friendly practices include soil carbon enhancement, reduction of pesticide usage, moisture retention, and water saving, etc.; inclusive green value chains maximize economic returns and increase profitability, for example fair trade and organic agriculture. CMSA and SCI are examples of green agriculture.

level with the objectives of identifying location-specific needs of farming communities and fulfilling them through coordinated action. In the villages where CMSA does not exist, ATMA staff (after training on CMSA) work with SHGs, their federations, and other farmers to popularize CMSA. Also, this established linkage with the line departments, research organizations, NGOs, and agencies associated with agricultural development in the districts. Further, the government of India has adopted CMSA as a national policy⁵ under the National Rural Livelihood Mission.

Civil society organizations, such as Action for Social Advancement, Professional Assistance for Development Action (PRA-DAN), and the Centre for Sustainable Agriculture, also supported pilot initiatives and helped scale-up agricultural interventions. Commercial banks, such as the State Bank of India and Punjab National Bank, provide credit linkages for poor households. In Bihar, two national-level universities, Banaras Hindu University and Rajendra Agricultural University, have collaborated with the project to train their graduate students on green agriculture. These graduates will be joining key positions in government departments and the private sector and will promote green agriculture, thus modeling project practices.

Thus, both CMSA and SCI have a four-pronged strategy to improve productivity and profitability, and to reduce adverse environmental footprints—natural resource management (NRM), financial interventions, market exchange, and an institutional platform for farmers. For NRM, farmers apply locally tested, ecofriendly bio-pesticide techniques supplemented by biological and agronomic soil fertility

5 The project is called Mahila Kisan Saskthikaran Pariyojana. Its primary objective is to empower women in agriculture by making systematic investments to enhance their participation and productivity, and also create and sustain agriculture-based livelihoods of rural women.

improvement measures. These interventions are knowledge-intensive and are adopted after prolonged observation and trials, replacing high-cost inputs. The interventions were supported by financial interventions that are available at their doorsteps and through 'a single window.' Easy availability of and accessibility to financial services (credit and agricultural insurance, food credit, etc.) helps farmers to make timely decisions and readjust farming if they need to in case of climatic or market shocks. Also, this system protects them from moneylenders.

Agricultural production is supported by guaranteed market access. These products have their own niche and branding and are in high demand. In addition, through value addition and aggregation, farmers can increase their profitability and bargaining power. Finally, institutional support provides farmers with a platform for knowledge exchange and innovation, a local seed bank, and a system for leveraging external and additional resources from the

government and other sources.

CMSA practices have helped reduce chemical pesticide and fertilizer use in the state. Based on internal estimates and data from the field, state-wide pesticide usage has declined by 7-9 percent. In the CMSA project areas, there is an annual reduction of 375 metric tons of pesticide use in paddy, 107 metric tons in chili, and 601 metric tons in cotton. The fertilizer reduction is similarly significant. The annual reduction in use of urea is 175,000 metric tons, and for diammonium phosphate (DAP) it is 875,000 metric tons.

Farmers have already reported a noticeable drop in pesticide-related health problems. A survey of three districts has shown a 40 percent reduction in hospitalizations related to pesticide poisoning after the adoption of CMSA. Furthermore, anecdotal evidence from the field suggests that, in areas of CMSA, groundwater quality has also improved. Biodiversity has been on the increase, and farmers report the return of many birds, butterflies, bees, and

Table 1. Expected environmental outcomes and their associated indicators

Expected Environmental Outcomes	Indicators
Reduction in methane gas emissions	Methane flux measurements Area under SRI cultivation in hectares
Fewer nitrous oxide emissions	N ₂ O emissions Reduction in usage of nitrogenous fertilizers
Groundwater depletion	Area under SRI cultivation in hectares Electronic water-level indicators—before and after the intervention
Restoration of aquatic biodiversity	Shannon–Weaver index Area under reduced usage of chemical fertilizers
Increased population of friendly insects	Presence of earthworms, honey bees, etc. Setting of grains (percent of filled vs. unfilled grains)
Soil conservation	Area treated with soil conservation measures
Increased soil micro-flora and micro-fauna population	Increased activity of soil micro-flora and micro-fauna population
Reduced use of pesticide	Net cropped area with no use of chemical pesticide

fishes in their paddy fields, and the reappearance of local earthworms.

CMSA practices help farmers during low rainfall and drought to cope with the reduction in agricultural inputs (chemical pesticides and fertilizers); and cheaper credit and increased access to extension services have contributed to a reduction in cultivation costs.⁶ According to external studies and internal MIS data, savings due to CMSA range from US\$8 per acre to US\$57 per acre (US\$30 to US\$147 per hectare).

In Bihar, the project is still under implementation, and one of the key indicators of reduced environmental impact is the adaptation of SCI methods. SCI was introduced by the NGO PRADAN in Gaya district in 2007 as an action research initiative in 14 villages, with 128 farmers using the methods for rice on 30 hectares. The success of the initiative led to its scaling-up in 2008 to 5,795 farmers, with *Jeevika* starting support the following year. By June 2013, 300,000 farmers had accessed agricultural productivity enhancement through the new methods.

Inspired by the success of *Jeevika*'s intervention on SCI, the government of Bihar has made a policy to cover 10 percent of paddy and wheat cultivable areas of the state under SCI. According to a current estimate, this will be eight million acres for paddy and 5.7 million acres for wheat. This will help thousands of smallholder and marginal farmers across all districts in Bihar.

The faster adoption of SCI is due to increasing profitability, which is a result of increasing productivity and reduced agricultural input use. A project, Sustainable Livelihoods and Adaptation to Climate Change supported by the Global Environmental Facility, is under preparation. This

project has a provision to support the measurement and documentation of environmental services and ecological footprints in *Jeevika*'s SCI.

Measurable outcomes with relation to economic/welfare effects are the following:

- Reduction in cultivation cost;
- Increased net income;
- Additional land taken on lease for SCI;
- Increased food and nutritional security;
- Applying System of Rice Intensification concepts to other crops; and
- Using efficient water management relevant to that crop.

ANALYSIS AND LESSONS LEARNED

A key objective of a green agriculture project should be smallholder farmers' profitability. This includes cost reduction in agricultural inputs, provided that production levels do not decline. Some farmers try to leave agriculture because it is not profitable. Here, profitability is a function of agricultural inputs, processes, production, and market access. In CMSA, input cost is decreased by applying bio-fertilizer and pesticide, while in SCI plants are enabled to absorb nutrients from their environment. The process is supported by access to low-interest credit, localized training, peer learning, etc., and production is aggregated through group marketing arrangements. In some cases, value is added through processing, and finally a market premium is realized for higher quality. Environmental services of agriculture and a reduction in the ecological footprint are imbedded in each step.

Effective institutional arrangements among key players are critical to the success of these initiatives. CMSA and SCI were managed by a vertically federated community institution.

- The first tier, the village organization (VO), is entrusted with overall program management at the village level and is

⁶ Although some of these savings are offset because of higher labor costs as CMSA farming can be labor-intensive. The labor costs have been factored in for profit calculations.

at the center of all agricultural activities in the village, which starts with forming farmer self-help groups (FSGs).⁷

- The FSGs and VOs develop an agricultural plan on capacity building, production, maintaining internal controls, and marketing. The sub-district federation monitors implementation, handles extension services, coordinates with service-provider NGOs, and liaises with the Department of Agriculture's Krishi Vigyan Kendras (Agricultural Science Centers).
- A district-level federation oversees implementation, forms tie-ups for marketing, and coordinates with the District Rural Development Agency to link up with relevant government programs.⁸
- Smallholders can't create the demand-side stimulus for sustainable agriculture if they do not act collectively and aggregate their voice, capacity, and leadership. The creation of social capital on a large scale with associations and federations leads to a change in the rules of the game and the nature of interaction between smallholders and the market. This social capital should be considered a core investment as it helps in transforming human, natural, and economic capital.

Farmers managed initial piloting and experimentation and scale-up through community institutions. NGOs provided first-level experimentation and technical support. Dedicated autonomous institutions of the government helped farmers to contextualize the CMSA and SCI to their own situation, which increased the rate of

experimentation. Also, investments were made to create a community institutional platform, through farmers' organizations, their federations, community resource persons, and a Farmer Field School to scale-up green agriculture. In Bihar, field-level extension staff were oriented on the FFS approach and subsequently engaged in promoting SCI in other areas of the state. The Department of Agriculture, Government of Bihar, has been drawing lessons and field experience from *Jeevika* and is facilitating SCI scale-up statewide. However, the context and model of interaction with the government need to be carefully developed.

The management of green agriculture projects has important ingredients, such as:

- SERP and *Jeevika* provide a single-window approach for the delivery of livelihood improvement services and enterprises, exclusively for small-farm holders at their doorstep, which provided all services within two kilometers of the farmer's house;
- Ensuring that project management is flexible and enables feedback, especially on outcomes and goal achievement. In projects, this was accomplished through the close coordination between farmers and advisers and continuous monitoring of outcomes at the field level;
- Green agriculture initiatives don't have to address all aspects of green at the same time; rather, this should be sequential. It is critical to decide and design which part of green to start with. Also, smallholder farmers can't survive on crops alone; livelihoods should be supplemented and diversified to include poultry, livestock, and a range of other enterprises. In Bihar, the state government's ministry was open to learning, and it was easier for the central government ministry to push the agenda; once successful, this innovation was

7 A group of 20-25 farmers forms a farmer SHG (Sasya Mitra Sangha), each paying a small registration fee. There are four to five farmer SHGs in each village. Most of the SHGs have been constituted of women farmers.

8 For example, CMSA activities have been synchronized with the National Rural Employment Guarantee Scheme, which funded the preparation of compost pits and digging of village tanks as a part of the public works program.

mainstreamed into the state's agricultural initiatives. The entry point for green agriculture was contextual to the ground realities. Since the beginning, the state was obsessed with productivity and production. In Bihar, a majority of the farmers are smallholders, and they were borrowing money from moneylenders to meet food expenses. Once farmers experienced food security and surplus, adoption became very fast. The adoption was accompanied by diversification of crops; for example, SCI started with paddy and then moved to wheat and vegetables, oilseeds, and pulses; and

- Monitoring of experimentation should be more rigorous to ensure availability of good-quality data. ICT, especially digital libraries, should be used. Community and third party monitoring is another approach to monitoring outcomes.

For policy makers, the main lesson is that the entry of green agriculture in this case was profitability. NGOs should use their comparative advantage; they are good with first-level experimentation. However, the same expertise and experience may not work with scaling-up, especially if they lack resources for this. The government should understand that there are certain activities that it can and can't do, for example, the formation of producers' groups, agricultural micro-planning, creating a platform for regular sharing of information between farmers and farmers' groups, etc. Keeping these and other limitations in mind, the government should create a sensitive support architecture.

The experiences and outcomes of CMSA and SCI have provided insights and evidences to policy makers, agronomists, and development professionals for dialogue and debate, and to explore the environmental soundness and economic viability of both approaches (Pulla, 2014; Mishra and Reddy, 2011; Reddy et al., 2014; Barah

et al., 2014). In addition, they require rigorous research, evaluation, and documentation. Up-scaling and mainstreaming of these approaches also requires close interactions between agricultural extension systems, rural development communities, and policy makers.

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AQUACULTURE PRACTICES AND COMMUNITY-BASED MANGROVE REHABILITATION IN INDONESIA

Dale Yi, Thomas Reardon, and Randy Stringer

10

SUMMARY

This study focuses on mangrove rehabilitation by export-oriented aquaculture producers in Indonesia. Initially, shrimp producers cleared mangrove forests to expand production. Adoption of a higher-yielding shrimp variety increased demand for the previously abundant mangrove ecosystem services. As a result, producers began working cooperatively through village institutions to restore the mangroves.

BACKGROUND

Mangroves are highly productive ecosystems that provide food and breeding and nursery habitats for fish and crustaceans. Mangroves serve as sediment sinks, provide nutrient-recycling services, and protect coasts from flooding, storm surges, and sea-level rise. With the expansion of cities and farms onto coastal lands, the world has lost 86 percent of its mangrove resources in the last quarter century, leaving many coastal communities in a “world without mangroves” (Duke et al., 2007).

In Indonesia, recent reports document losses of mangroves from 3.5 million hectares in 1988 to 1.2 million hectares in 2007 (ADB, ILO, and IDB, 2010). The reasons Indonesia’s marine ecosystem is endangered include sediment discharges, agricultural and industrial pollution, and unsustainable fishing practices (OECD, 2012). This case study focuses on how numerous coastal villages in Indonesia are reversing the trend in mangrove destruction. The case presents collective, community-based mangrove rehabilitation activities by

Location

South Sulawesi & Central Java, Indonesia

Timeline

ongoing

Land Use

aquaculture or mangrove

Partners

local government, cooperatives

Role of Government

regulator

export-oriented small aquaculture producers in 75 coastal villages of Central Java and South Sulawesi, Indonesia.

Over the past two decades, Indonesia’s small aquaculture producers farmed two shrimp varieties. Initially, producers of the traditional shrimp variety, monodon, cleared mangrove forests to expand production. A much higher yielding shrimp variety, vannamei, was introduced around 2004. The more intensive vannamei production systems demand more ecosystem services (clean water, erosion mitigation, etc.) that are provided by the once-abundant mangrove forests. As a result, villages with vannamei producers began to work cooperatively through village institutions to restore mangrove forests.

EVOLUTION OF THE INITIATIVE

Aquaculture and capture fisheries contribute importantly to Indonesia’s

economic development. More than 50 percent of animal protein consumption comes from fish in Indonesia (Kawarazuka and Béné, 2011). One of the most important coastal economic activities is aquaculture. In 2010, an estimated 3.4 million households practiced aquaculture, increasing from 2.1 million in 2000 (FAO, 2012). By the mid-2000s, Indonesia had become the second-largest global shrimp producer, the fourth-largest shrimp exporter in volume terms, and the fifth-largest in export value (FIAS, 2006).

Shrimp aquaculture productivity in Indonesia, however, is among the lowest in the world, with average annual aquaculture output around one metric tons per farmer, compared with four in India, seven in China, and 35 in Chile (FAO, 2012). The low productivity of farms combined with strong potential for development are reasons behind a presidential decree that prioritized intensive expansion in the country's shrimp industry and permitted the commercial import of *Litopenaeus vannamei*, a high-yielding shrimp variety (HYV), in 2004. *Vannamei* is native to the waters of Central America and is bred specifically for its productivity attributes. Compared with the traditional variety, *Penaeus monodon*, *vannamei* are (1) more resistant to damaging shrimp pathogens, (2) adaptable to high stocking densities, and (3) more efficient in converting feed into meat mass.

In practice, *monodon* shrimp inhabit only the bottom of the aquaculture ponds. These traditional varieties require a much more extensive production system than *vannamei*, requiring more space to increase output. Consequently, for more than three decades, expansion of Indonesia's shrimp production depended on opening up new areas for production, including converting mangrove swamps into aquaculture ponds. Indonesia's mangrove forest cover decreased from 4.25 million hectares in 1982 (FAO, 1982) to just

2.4 million hectares by 2000 (WRI, 2000). *Monodon* shrimp aquaculture is responsible for much of the mangrove degradation during this period (Valiela et al., 2001).

In contrast, *vannamei* shrimp inhabit aquaculture ponds volumetrically. This is a relatively intensive production system, requiring not only feed but also the beneficial ecosystem services provided by mangroves. *Vannamei* producers began to appreciate and demand the water purification and related economic benefits provided by the mangroves. For example, the tidal flows combined with the mangrove are able to flush the pond effluents that result from the intensive production systems.

As in many other countries, approaches to mangrove rehabilitation in Indonesia range from top-down centralized approaches to regional and local community-based programs. The top-down strategies involve programs and policies designed and implemented by the central government, NGOs, or donor agencies. In contrast, decentralized rehabilitation initiatives are designed and implemented by the villages that make direct use of the mangrove forests. Examples of top-down approaches are enacting laws against mangrove clearance, declaring protective zones, changing property rights, and establishing mangrove-replanting programs. To date, evidence suggests that these protected zone strategies, legislative initiatives, and centralized replanting efforts have had limited success, with high implementation and monitoring costs (Hayes, 2006; Walters et al., 2008). As a result, programs began to shift toward decentralized conservation initiatives.

Indonesia has four main levels of government with some responsibility for mangrove management: (1) national, (2) provincial, (3) district, and (4) village. These different administrative levels govern mangrove resource use through several

agencies, including the Ministry of Forestry, Ministry of Marine Affairs, Ministry of Life Environment, Ministry of Home Affairs, and National Land Bureau. These agencies administer numerous laws and regulations that govern the management of coastal mangrove resources. Effective mangrove management is difficult because of the high coordination costs across these different government bodies and administrative levels and the complex and even inconsistent regulations.

For instance, in Indonesia, various government agencies define differently the boundaries of a mangrove ‘green-belt,’ the protected zone where mangrove conversion is illegal. The Ministry of Agriculture declares the protective green-belt to be 200 meters (No. KB 550/246/Kpts/4/1984). The Ministry of Forestry declares it to be 200 meters on coastlines and 50 meters on river deltas (No. 507/IV-PHH/1990), and a Presidential Decree declares that it is 130 times the annual average difference between high tide and low tide (No. 32/1990). The presidential definition would require daily measurement of tides for an entire year before the boundaries of a green-belt could be drawn. Complex and inconsistent definitions of green-belts across government bodies and a lack of enforcement by different administrative levels of government mean that there are effectively zero meters of green-belt on the coasts of Indonesia. Top-down regulations in governing the management of mangrove resources have not been effective, and the responsibility of mangrove management falls almost entirely on the shoulders of coastal village communities.

In decentralized strategies, the management of natural resources occurs at lower organizational and administrative levels. One example is community-based natural resource management (CBNRM) approaches that tend to make better use of traditional social norms and practices

embedded in local institutions to coordinate individual households to achieve mangrove rehabilitation outcomes. Previous studies on CBNRM identify the key factors that determine successful governance of common-pool resources (Baland and Platteau, 1996; Ostrom, 1990; Wade, 1989). Agrawal (2003) classifies these factors into four categories: (1) characteristics of the natural resource that is being managed, (2) characteristics of the group of agents managing the resource, (3) institutional arrangements used in governance, and (4) external forces (markets, national policy, and technology). This case study analyzes all these important factors to identify the effect of aquaculture HYV diffusion on CBNRM mangrove management behavior. The study is based on interviews and household surveys of aquaculture producers from 75 coastal villages in Central Java and Sulawesi.

In the context of this study, the role of the local village-level government is the most important. Although it does not directly provide incentives or resources, the village government plays a critical role in facilitating the conditions that are necessary for the community to carry out programs to manage common-pool resources. The local government’s functions are to (1) serve as a public forum where programs and policies regarding the management of mangroves can be discussed and designed (legislative support), (2) ease the ability to recruit volunteer labor and effectively allocate it to mangrove rehabilitation (executive support), and (3) reduce the cost of monitoring community members and holding them accountable for their participation commitment (judicial support).

ANALYSIS AND LESSONS LEARNED

This case study focuses on understanding mangrove management practices among 75 villages in two provinces: Central Java and South Sulawesi. The two

regions represent distinct economic environments and natural resource conditions. The villages in Central Java are located in a relatively densely populated and developed region of Indonesia with accessible infrastructure and diversified rural economies. In contrast, the South Sulawesi villages are located in a much less developed region of Indonesia where the rural economies are highly reliant on agriculture. The randomly selected villages come from two purposely chosen districts from each province: one district near the main provincial port and one district distant from that port. This variation in geography allows the case study to capture a larger range of incentives, capacities, and resultant behaviors of shrimp farming households that exist in Indonesia.

Most coastal villages in Indonesia suffer from some mangrove degradation, thus increasing significantly their risk of tides, waves, currents, and drainage eroding land. Key informant interviews in the selected districts suggested that adoption of the input-intensive, higher-yielding shrimp variety increased demand for the previously abundant mangrove ecosystem services. As a result, producers began working cooperatively through village institutions to restore the mangroves. Mangrove rehabilitation involves collecting seeds from nearby mangrove forests and planting the seeds in suitable areas along the village coastline. Replanting is a relatively labor-intensive activity, requiring the participation of many village household members.

The research team learned that, out of the 75 coastal villages selected for the case study, 33 villages (44 percent) reported having implemented mangrove-replanting programs. This initial finding demonstrated a strong interest among some villages in rehabilitating mangrove forests. The research team learned that the villages with rehabilitation programs had

organizational structures, incentive systems, and administrative capacity to motivate and coordinate households to work toward a shared goal. In addition, the case study team observed differences across villages in their interest in and capacity to implement a replanting program.

After these initial site visits, the research team developed a village-level questionnaire designed to understand the steps involved in rehabilitation programs and to identify the key factors that facilitate or constrain the coastal villages' success in the implementation of mangrove-planting programs. The implementation of a mangrove-planting program in a village requires a significant amount of labor and the capacity to coordinate and manage the labor that must be committed to the program. A mangrove-planting program typically proceeds in three phases, each of which is labor intensive and requires coordination of many households.

The phases of the program were:

- **Inception:** In this phase, key mangrove stakeholders in the village must be identified and made known to each other. Not only must there be interest in replanting mangroves, but the level of interest among village members must be common knowledge. This involves primarily informal dialogue regarding the ecosystem services of mangroves and the feasibility of successful execution. To successfully complete the inception phase, there needs to be existing interest in the community in replanting mangroves. This must be accompanied by the village's ability to identify these key stakeholders and bring them together to initiate a mangrove-planting program.
- **Design:** Key stakeholders design the details of the work program to replant mangroves in the village. This involves forecasting how much labor will be needed from the community, how many saplings to transplant, and how to

prepare the coast for planting. To successfully complete the design phase, the village must have knowledge on how to rehabilitate mangrove forests and have the capacity to plan a collective action activity.

- **Execution:** The program details are communicated to the larger village community and volunteer labor is recruited from the village. The village labor is then used and managed to prepare the land, transplant saplings, and manage the newly planted mangrove stock. To successfully carry out the program, the village must have the capacity to coordinate individual households to work toward a common objective and enforce the decisions made by the community. Village communities have differing levels of capacity to carry out program tasks. Thus, the likelihood that a coastal community implements a mangrove-planting program tends to depend upon (1) existing interest in the community in replanting mangroves, (2) capacity to coordinate individual households to work toward one objective, and (3) capacity to enforce and execute village directives.

A statistical analysis of the behavior within 75 coastal villages (Yi, 2013) found that two important factors determine mangrove forest outcomes: (1) shrimp production technology and (2) village institutions. The shrimp variety is important because the production technology associated with each variety requires different ecosystem services from the mangrove systems. Village institutions are important because mangroves are a common-pool resource managed collectively by the community.

Aquaculture Production Technology

Villages with larger populations of HYV adopters were more likely to implement mangrove planting. This suggests that HYV farmers have more interest in

rehabilitating mangroves and that they value the ecosystem services of mangrove forest significantly higher than those using traditional production systems. The diffusion of HYVs is driving villages to invest in erosion-mitigating mangrove forests.

In contrast, villages with higher populations of traditional farmers were significantly less likely to invest in replanting mangrove resources. This is in line with past accounts that documented the initial degradation of this resource by traditional shrimp farmers. Traditional farmers that use extensive production systems are not interested in investing limited labor resources to replant mangrove forests.

Communities with widespread HYV diffusion had more interest in rehabilitating mangroves than communities with large traditional farmer populations. These results show that agricultural intensification and natural resource conservation are not necessarily mutually exclusive objectives. Some technologies, such as HYV shrimp, actually increase the use-value of mangroves to a community. It appears that, when productivity increases, communities are more willing to invest in mangroves to protect land from erosion. The diffusion of technologies that increase the demand for ecosystem services may be a more sustainable and cost-effective way to conserve and even rehabilitate natural resources.

Village Institutions

Aquaculture farmer cooperatives are playing a significant role in facilitating mangrove-planting programs in coastal village communities. Villages with aquaculture farmer cooperatives were 35 percent more likely to implement mangrove-planting programs than those without. These cooperatives appear to provide a forum to express interest in and facilitate the design of mangrove-planting programs. Typically, the functions of these cooperatives are to collectively manage aquaculture diseases

and manage shared waterways (canals, streams), and it appears that some of these cooperatives have extended their role into managing mangrove forests along their coastlines. On the other hand, the presence of labor-pooling cooperatives in the village did not have a significant relationship with the village's propensity to plant mangroves. The ineffectiveness of this cooperative in inducing positive mangrove outcomes may be due to the size and composition of its members. Although aquaculture farmer cooperatives tend to be composed of a small group of farmers with similar goals, labor-pooling cooperatives tend to be composed of a large number of households with divergent interests regarding mangrove planting.

These two findings demonstrate that simply establishing a cooperative in a village is not a panacea. To effectively improve natural resource outcomes, the cooperatives need to share a common goal regarding mangrove planting in order to be able to effectively initiate, design, and execute a collective planting program. This may mean that, when it comes to mangrove rehabilitation, the optimal cooperative may be small in size and be composed primarily of households that stand to gain from forest rehabilitation.

Finally, the villages' ability to impose sanctions on noncompliant village members was a significant factor facilitating the implementation of a mangrove-planting program. Villages with the ability to fine members were 36 percent more likely to plant mangroves than those that were not able to. When nonparticipation carries a penalty, it encourages households to contribute the labor that they promised to the group.

Although most villages rely on embedded cultural values and social traditions to enforce group directives, the study team concluded that the ability of a village to enforce its regulations more formally with

sanctions is a powerful tool for villages to govern and improve the management of common-pool resources. We see that this is especially effective in facilitating the implementation of mangrove-planting programs. With the ability to create credible threats for noncompliance or free-riding behavior, villages have the capacity to execute policies and programs more effectively. This means that shared objectives are only a part of the story. The ability of local governing bodies to enforce compliance with collective decisions and prevent free-riding behavior is critical to success.

This case study suggests that two important factors determine mangrove forest outcomes: (1) village institutions and (2) shrimp production technology. Village institutions are important because mangroves are a common-pool resource managed collectively by the community. The shrimp variety is important because the production technology associated with each variety requires different ecosystem services from the mangrove systems.

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MARKET INCENTIVES FOR ECOFRIENDLY SRI RICE PRODUCTION IN CAMBODIA

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11

SUMMARY

Since 2009, a private-public collaboration has created international market demand for rice produced by farmers in Cambodia, Indonesia, and Madagascar using ecofriendly techniques.

BACKGROUND

In Cambodia, Indonesia, and Madagascar, rice is the staple food, with 65 to 70 percent of the population directly engaged in rice farming. Most rice farms are managed by low-income, smallholding households and some tenant farmers, mostly cultivating less than 1 hectare. Smallholders account for almost all domestic rice production in each country. In all three countries, an increasing number of farmers are producing marketable surpluses of ecologically grown rice for export, using System of Rice Intensification (SRI) methods. This case study focuses on collaborative efforts in Cambodia to develop a value chain for the export of certified organic and Fair Trade rice produced by SRI farmers, in particular for export to the United States, but increasingly to countries in Europe and in the region.

Given the importance of rice to the country's diet and economy, Cambodia has made increasing rice production a high priority over the past two decades, for food security and, more recently, for export. In 2010, Cambodia had 2.79 million hectares of land under rice cultivation producing 8.25 million tons of rice, up from 2 million tons in 1980. It seeks to export 1 million tons in 2015 (Ros et al., 2011).

Most efforts for raising production have

Location

Cambodia

Timeline

2004-2014 (marketing component)

Land Use

rice cultivation

Partners

Cornell University, Lotus Foods, NGOs

Role of Government

enabler

focused on expanding cultivated area and raising yields through the use of fertilizers, pesticides, and new seeds (IATP/AFA, 2011). These strategies are unsustainable in the long run, however. The expansion of agricultural production area has resulted in a reduction in forest resources, undermining important livelihood sources and the delivery of critical ecosystem services. Fisheries are second only to rice in importance with fish consumption contributing 70 to 75 percent of the protein in Cambodian diets. Yet, important fishing grounds are threatened. Overuse and misuse of fertilizers and other agrochemicals, plus increased extraction of surface water and groundwater for agriculture, have led to pollution and depletion of water sources and a reduction in wetlands and associated habitats.

These effects are compounded by the effects of climate change, especially irregular rainfall with more flooding and drought. Increasingly, water shortage is

a major constraint to sustaining or improving productivity. In a recent survey, 80 percent of the rural households interviewed suffered from water shortages for agricultural uses, while more than half suffered from water shortages for personal uses (IFPRI, 2013). The rice sector is not only the primary user of water but also the main source of methane emissions.

SRI is an agroecological methodology for increasing the productivity of irrigated rice by changing the management of plants, soil, water, and nutrients. SRI was developed in Madagascar in the 1980s and is based on the cropping principles of significantly reducing the plant population, improving soil conditions and irrigation methods for root and plant development, and improving plant establishment methods. Key practices include transplanting younger and single seedlings at 8-14 days (instead of 21-30 days) at wider spacing and keeping soils moist and aerobic, rather than continuously flooded, to promote root growth and beneficial aerobic soil organisms. A simple conoweeder is used to remove weeds while also aerating the soil surface. SRI methods lend themselves to farmer adaptations, and even partial implementation of practices results in improved yields.¹

1 The benefits of SRI have been demonstrated in more than 50 countries. They include 20-100 percent or more increased yields, up to a 90 percent reduction in required seed, and up to 50 percent and more water savings. SRI principles and practices have been adapted for rainfed rice as well as for other crops (such as [wheat](#), [sugarcane](#), and [teff](#), among others), with yield increases and associated economic benefits. See Uphoff, Norman. 2012. Supporting food security in the 21st century through resource-conserving increases in agricultural production: *Agriculture and Food Security*, 1:18. <http://www.agricultureandfoodsecurity.com/content/1/1/18>

EVOLUTION OF THE INITIATIVE

Introduction of SRI

The starting point for this initiative was similar in all three countries: an effort to improve the productivity of smallholders' rice cultivation while reducing their dependence on purchased fertilizers and agrochemicals, and promoting more ecologically-based management of natural resources. The Cornell International Institute for Food, Agriculture and Development (CIIFAD) became engaged in evaluating and extending SRI in the mid-1990s under the auspices of a USAID project to protect rainforest ecosystems in Madagascar, having learned of the new methodology from a local NGO (Tefy Saina). After several years of validation in Madagascar, CIIFAD reached out to scientists and government officials in other rice-growing countries to raise awareness about SRI methods and encourage more research.

The Centre d'Étude et de Développement Agricole Cambodgien (CEDAC) is a Cambodian NGO founded in 1997 to develop and disseminate innovations in ecological agriculture. CEDAC learned about SRI in 1999, and its director began trials with 28 farmers in Kandal Province in 2000. After the success of an increasing number of on-farm trials, several international NGOs and donor projects funded training and extension of SRI in rural areas with technical assistance provided by CEDAC. At the time, national rice yields averaged 1.6 to 2.0 tons per hectare. In 2004, when an estimated 10,000 farmers were using the practices, the German development agency GTZ (now GIZ) conducted the first systematic evaluation of SRI. The evaluation found that yields had been increased on average by 41 percent with SRI methods, and that the proportion of farmers facing rice insecurity declined from 34 to 28 percent. At the same time, the farmers able to produce a surplus increased from 20 to 33

percent (Anthofer, 2004).

The Cambodian government officially endorsed SRI in 2005 and included it in the National Social Development Program 2006–2010. The Ministry of Agriculture, Forestry and Fisheries (MAFF) set up a small secretariat to coordinate and promote SRI in Cambodia with GIZ and Oxfam assistance. Since then, the Minister of Agriculture has officially instructed all Provincial Departments of Agriculture to promote SRI throughout Cambodia.

Increased Production, Surpluses, and Emergence of Commercialization with Support from Different NGOs

In Cambodia, by 2004, many farmers applying SRI methods were growing enough rice to meet their household needs and were generating marketable surpluses. Most farmers sell their rice at harvest time for very low prices dictated by traders, with no premium for better quality. The surplus of rice generated through the introduction of SRI methods made it more urgent for farmers to be able to differentiate their chemical-free rice and obtain higher prices. Oxfam GB and Oxfam America provided a small grant to CEDAC to open a retail store and then several branches in Phnom Penh, where surplus organically-grown SRI rice could be sold at a somewhat higher price to urban consumers, thus further enhancing farmers' incomes. The stores were also a means of making urban consumers more aware of the merits of organic production.

Also in 2004, CIIFAD began working with NGOs and farmer-based organizations in several countries to obtain expert assistance on marketing. Farmers in Sri Lanka and Madagascar were having challenges similar to those in Cambodia, and grassroots programs having trained farmers on rice production needed now to figure out how to manage rice surpluses but lacked expertise related to marketing. CIIFAD's

initiative, titled "A Global Marketing Partnership for SRI Indigenous Rice" received one of the first SEED Awards in 2005. This led to a modest grant from the U.S. State Department to further CEDAC's efforts to organize organic producer groups and develop the necessary internal control standards for organic certification that would meet U.S. and European standards. GIZ and Germany's Senior Expert Service played key technical assistance roles in this process. Funding was also used to underwrite two due-diligence visits by the owners of the U.S.-based rice-importing company Lotus Foods to Madagascar and Cambodia, in 2006 and 2007, respectively.

Lotus Foods: A Major Step Toward Commercialization

Established in 1995, Lotus Foods pioneered the introduction of Chinese black rice (trademarked as Forbidden Rice®) and Bhutanese red rice to the U.S. The company's stated mission is to contribute to agricultural sustainability, preserve rice biodiversity, and guarantee rice-farming families a decent income. Their rice products are distributed throughout North America in mainstream retail and natural food stores. CIIFAD approached the company in 2005 regarding its interest in working with SRI farmers to create a link to U.S. markets for their ecologically-grown traditional rice varieties. In 2008, having satisfied themselves that the needed infrastructure was in place to procure and process rice to meet international standards, the company's co-owners decided to move forward, starting with the import of one container (18 tons) each of finished rice from Cambodia, Indonesia, and Madagascar.

In 2014, Lotus Foods expects to import 320 tons of *Phka Malis* (jasmine) rice from Cambodia alone, and 760 tons of rice sourced from mostly smallholder farmers in six countries. The 'heirloom' varieties of

SRI-grown rice from Cambodia, Indonesia, and Madagascar are sold across the U.S., branded as “[More Crop Per Drop](#).” They are certified organic and Fair Trade. The response from the food industry has been very positive, with stores such as Whole Foods Market, Safeway, Wegmans, and Costco expressing support for the efforts of Lotus Foods to promote greater sustainability in rice production and greater inclusivity of small-scale farmers. In the past five years, Lotus Foods has been contacted by projects and enterprises seeking to market SRI-produced rice in a growing number of countries, including Mali, Sri Lanka, Tanzania, India, Liberia, Vietnam, and Nepal.

A critical early driver was the push from Lotus Foods for organic certification of the rice. While the company was prepared to pay a premium for SRI rice, there was an increasing demand from buyers in the U.S. natural food sector for organic certification. CEDAC has organized a national network of 93 organic rice producer cooperatives that supply the export market and an additional seven retail stores that CEDAC has opened. BCS Öko-Garantie-GmbH from Germany is doing annual inspections and organic certification. As a third party, it provides the organic certification adhering to European and U.S. organic standards. Fair TSA is responsible for the Fair Trade certification. A social development fund is generated through a small contribution from each kilogram of paddy sold under the Fair Trade label. With this fund, farmers decide jointly within their community how to apply the funds to improve their living conditions. They can reinvest in the rice cooperative or can invest in commune halls, schools, roads, or public sanitation or environmental conservation activities, such as constructing reservoirs and ponds.

With support from GIZ and with government authorization, CEDAC is now

working on a national organic standard for the domestic market and a baseline for later benchmarking with international standards such as NOP (U.S.) and EEC Regulation (EU). The region now has several initiatives such as AROS (ASIA Regional Organic Standard) and ASOA (ASEAN Standard for Organic Agriculture).

Growing Exports and Evidence on Environmental Benefits

SRI producers usually retain some share of their produce for household consumption or to sell into local markets. Organic *Phka Malis* is grown by small farmers, mainly from Kampong Chhnang, Kampong Speu, and Takeo provinces. Around 50 percent of a one hectare rice field is used to grow organic jasmine for the market and for export. The rest of the field area is cultivated for family consumption. Farmers can harvest from 2.5 to 3.5 tons per hectare of certified organic fragrant rice, while very good SRI farmers can obtain more than 5 tons per hectare. Generally, fragrant rice yields are around 25 percent lower than those of non-fragrant rice, but the higher prices for fragrant rice varieties are an important incentive for farmers.

In 2012-2013, CEDAC procured 1,114 tons of organic paddy from 637 farmers in five provinces, up 36 percent from 2011-2012. Of this total, 585 tons were certified by BCS as organic and Fair Trade for export to U.S. and EU markets. In 2013, CEDAC exported 274 tons of milled rice (white and brown rice) to the U.S. According to a survey conducted by CEDAC in 2012, organic rice farmers participating in CEDAC's organic rice program earned on average a net annual income of around US\$750 in 2012. It was calculated that conventional farmers not cooperating with CEDAC incurred a loss of around US\$7 per year from their rice cultivation due to higher input costs, lower yields and lower market prices. In addition, a community participating in the

Table 1. Production of organic paddy during the 2013–2014 season

Type of Organic Rice	Number of Farmers	Area (hectares)	Production (metric tons)
Fully organic to be certified by BCS	454	700	2,234
Organic in conversion with ICS (internal control system)	1,311	763	2,486
Total	1,765	1,463	4,720

CEDAC program received US\$9,673 as their Fair Trade social development premium.

A major challenge for CEDAC is to be able to purchase all available organic rice. Although it continues to train and organize organic producer groups, because it does not have enough working capital, it could purchase only 67 percent of the fully-certified organic paddy, or 31 percent of the total organic paddy (including in conversion) available from the 2013 crop season. These amounts are dwarfed by the total rice exported by the country: 378,856 tons of finished rice in 2013, up about 70 percent from 205,717 tons in 2012 (SOWS, 2014).

CEDAC estimates that about 200,000 farmers are now using SRI methods. Many of these farmers are contributing to the growing volume of rice available for export, but they are generally not capturing any price premiums for growing their rice more sustainably. Several cooperatives are now working with CEDAC to establish their own community rice mills, fueled by bio-gasifiers. This will keep the valuable by-products of rice processing within the community, generate employment, and create a more robust rural economy.

The economic and environmental benefits of SRI are considerable. To facilitate the systematic analysis of experiences with SRI in Cambodia, CEDAC conducted a longitudinal evaluation of farmers who had used SRI methods for three years (2001, 2002, and 2003). The evaluation showed that even incomplete use of SRI practices

enabled them to obtain 2.75 tons per hectare on average, compared with 1.34 tons per hectare with conventional means. Use of chemical fertilizer use declined from 116 to 67 kilograms per hectare on average, and farmers' expenditures for chemical pesticides fell by 93 percent. Overall costs of production declined by half, and household income, even with the use of SRI on only part of families' rice land, was almost doubled (Tech, 2004). With higher rice yields, they can take some of their land out of rice cultivation and can redeploy it, to have fish ponds and raise vegetables, legumes, and fruit, also poultry, and sometimes frogs, that will raise their net incomes and reduce their reliance just on rice production.

Because of the greater root growth and larger, more active populations of beneficial microorganisms, SRI rice plants can perform well with reduced applications of water, with water savings usually of 30–50 percent for irrigated rice. Since a majority of rice in Cambodia is grown without irrigation, relying on rainfall, these savings are not as important in Cambodia as elsewhere, but farmers' rainfed SRI rice can withstand better the frequent shortages of water that put stresses on the crop. A major environmental benefit from stopping the continuous flooding of rice paddies with SRI management is that methane emissions from the paddies are greatly reduced, and a number of studies have shown that there are no offsetting

increases in nitrous oxide, another and more potent greenhouse gases (Dill et al., 2013; Gathorne-Hardy et al., 2013). A study at Kangwon National University in Korea calculated a reduction of 73 percent in CO₂ equivalents, compared with conventional flooded rice (Choi et al., 2014). Recently, an analysis of greenhouse gases and mitigation strategies in Vietnam recommended that SRI be promoted as a potential solution for low-emission rice cultivation (Dao et al., 2014).

ANALYSIS AND LESSONS LEARNED

With an increasing rice surplus and evident success of rice export projects, the Cambodian government shifted some policy emphasis from national food security to increasing rice exports. In 2010, the government released a policy on the promotion of rice production and milled rice exportation, with the goal of exporting 1 million metric tons of milled rice by 2015. The vision is to bring Cambodia into the world market as a key milled rice-exporting country, with a commitment to removing all barriers to milled rice export.

The experience of Cambodia offers important lessons to other governments and organizations involved in similar initiatives.

- **Government intervention to increase capacity and quality throughout the rice value chain is essential.** However, unless there is an express focus on sustainability, organic production, and inclusion of smallholder farmers, the value chain becomes largely extractive, with major beneficiaries being large mill operators and other corporate interests. The needs of organic farmers, agricultural cooperatives, and small and medium 'green' enterprises should be considered at all points along the value chain from production to collection, processing, logistics, financing, and marketing to encourage their participation and success.

- **Identify private partners who are committed and willing to form long-term relationships.** Acknowledge the difficulties of such relationships and address them through the availability of some financial support and incentives. Few programs (Sida's IAP is an exception) offer grant funds to small and medium-sized, for-profit companies. In particular, programs that help small companies mitigate early risk are needed. For a small business like Lotus Foods to work directly with a complex and diverse constellation of actors (farmer cooperatives, NGOs, start-up enterprises, and universities) is a major challenge. This requires principals who are committed to building long-term relationships, who are willing to invest the time and money in the capacity building necessary for these operations to grow, and who are not trying to maximize profit just in the short term, rather aiming for sustainable and equitable outcomes over time.
- **Make sure that the country has sufficient capacity to support 'green' initiatives that include small-scale producers.** In addition to adequate infrastructure (milling, packaging, transport, and relative ease of access to a seaport in the case of export), there must be institutional capacity to coordinate logistics. Many farmer cooperatives are expert at growing good-quality organic rice, but do not have the capacity or interest in managing a complex marketing operation. There needs to be a company or NGO intermediary that is prepared to play that role. None of the in-country partners in this case study had any prior experience with export. They had to learn on the job. The value chains had to be developed from scratch, with Lotus Foods providing the critical guidance in each step for the rice to meet the necessary standards for organic importation into the U.S.

- **Government programs are only as effective as the people who are implementing them.** This means that, at both the local and national levels, if a key person who has supported organic production is moved to another division, the program can disappear. Political agendas can undo much good work. Although many developing governments have extended support to isolated sustainable agriculture initiatives, there is still seldom any long-term commitment to agroecological farming. This lack of commitment has constituted a barrier to private investments in green farming operations and supporting industries such as packaging or in the large-scale manufacture of low-cost farm tools.
- **Success can bring just as many challenges as starting up.** It can trigger the need for more working capital for inventory financing, to achieve adherence to higher standards of international quality control and management, payment for certifications, hiring qualified staff, or purchase/rent of more sophisticated equipment. It is necessary to establish flexible credit programs or revolving loan funds with low interest rates that enterprises could prequalify for based on orders and receivables, which would give them the capital that they need to grow.
- **Consumers and the media are important allies in developing long-term support for agroecological enterprises.** CEDAC has organized many consumer field trips that connect consumers, students, government officials, and journalists with farmers.
- **Small-scale organic and Fair Trade rice export initiatives can help jump-start a green economy through a demonstration effect, though the most stable market over time will usually be domestic.** Citizens must be able to trust

government certification programs. Public health agencies can work with the media to communicate the value of organic food production to people's health and to the country's environment by applying fewer or no agrochemicals and also the value of conserving rice biodiversity, especially red and black rice varieties that have high nutritional value.

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CERTIFIED COCOA PRODUCTION, CONSERVATION, AND LIVELIHOODS, DEMOCRATIC REPUBLIC OF CONGO

Jean-Remy Makana, Tom Evans, Michelle Wieland,
Miguel Leal, and Phillip Betts

12

SUMMARY

Smallholder cultivation of cocoa in eastern Democratic Republic of Congo (DRC) can result in considerable carbon emissions and biodiversity loss from deforestation, as well as pollution from fungicides. Price premiums from organic certification are being combined with other measures to drive a transition to more environmentally friendly approaches to cocoa production on a large scale.

BACKGROUND

Cocoa is an increasingly important crop in eastern parts of the Congo Basin and the adjacent mountains of the Albertine Rift. This case study reviews smallholder cocoa production in the war-ravaged North Kivu and Orientale provinces of eastern DRC. Here, the natural vegetation is mainly very extensive lowland and upland rainforest, with smaller areas of secondary growth, fallow land, and agricultural fields around villages. The villages are concentrated along the few roads that traverse the area, and comprise a mixture of long established and relatively new settlements occupied by several different ethnic groups.

Production is mostly done by households cultivating 0.5 hectares to 5 hectares of cocoa as part of a mixed farming system that also typically includes annual crops, small livestock rearing, and collection/sale of forest products. Cocoa has the potential to become the dominant source of income for a high proportion of farming families in the landscape. Growers conduct first-stage processing themselves and then sell the beans into supply chains that

Location

Democratic Republic of Congo

Timeline

2009-present

Land Use

before: farmland, fallow, and secondary forest; after: shade cocoa

Partners

government agencies, private sector, NGOs

Role of Government

definer, funder, promoter

lead to international markets. The crop is a relatively new arrival in most of the area, in particular in Mambasa Territory, where the first plantings took place only in 2003.

Depending on the type of vegetation that it replaces and the methods used, cultivation of cocoa in this landscape can result in significant carbon emissions and biodiversity loss from deforestation. A preliminary analysis indicates that full sun cocoa cultivation can lead to a reduction of up to 90 percent of biomass in secondary forest (see Figure 1). Pollution from fungicides is also a concern. The carbon stocks of the various vegetation types are currently being assessed to allow an accurate determination of the emission factors and deforestation statistics are being collated to allow estimation of total emissions from agricultural conversion under various scenarios.

Cocoa is just one of a variety of crops

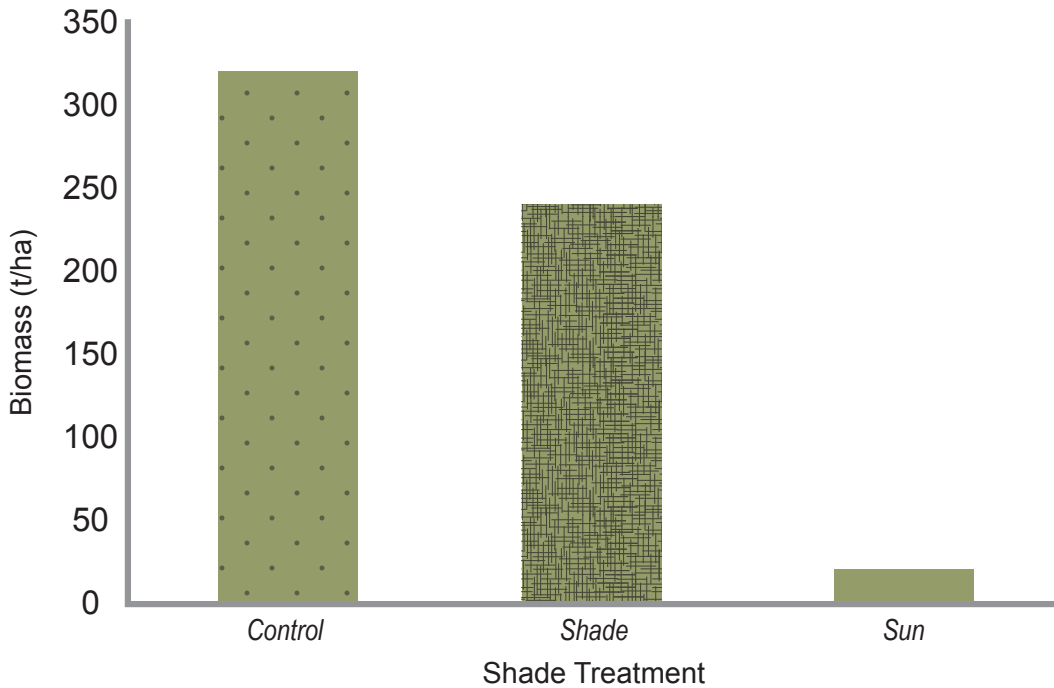


Figure 1. Carbon stocks (biomass) conservation in shade cocoa cultivation orchards. Sun represents ‘full sun’ cocoa fields, Shade represents cocoa planted under the shade of native trees, and Control is undisturbed nearby secondary forests

that lead to deforestation in this landscape, though it is currently the most profitable and so it is increasing in its relative importance. The demand for new land for agriculture of all kinds is driven by individual farmers seeking to enlarge their farms so as to improve their livelihoods. The benefits of doing so have increased as transport links (and hence access to markets) improve. This rising demand for land is exacerbated by demographic growth, in particular migration from the adjacent provinces of North and South Kivu, which have very high population densities and severe security problems.

Cocoa production is relatively new in the region but volume increased 18-fold from 322 tons in 2008 to 5,888 tons in 2013. Given that the new cocoa farms produce approximately 700 to 800 kilograms annually, the expansion of cocoa area can be estimated from 430 hectares in 2008 to 7,890 hectares in 2013. ESCO Kivu export

accounts for roughly 92 percent of the total. Cocoa brought approximately US\$10.9 million into the area in sales in 2013.

EVOLUTION OF THE INITIATIVE

A private enterprise, ESCO Kivu initiated certified cocoa production in eastern DRC in the early 2000s. The initiative was then supported by the government in partnership with the Wildlife Conservation Society (WCS) to pilot ways to minimize the threat to primary forests from agricultural expansion in Mambasa Territory, Orientale Province, under the framework of the national REDD+ readiness process. In addition to reducing greenhouse gas emissions, the initiative intends to reduce deforestation pressure on an adjacent World Heritage Site, the 14,000 square kilometer Okapi Faunal Reserve. Cocoa production is illegal inside the reserve, but legal and encouraged outside. The creation of livelihood benefits in parallel

with environmental benefits is also an important objective.

The Ministry of Environment, Nature Conservation, and Tourism of the DRC is leading the work of a partnership that also includes smallholders, the private sector (the firm ESCO Kivu), and NGO partners (WCS and Worldwide Fund for Nature, WWF) to pilot market-based solutions to this issue. Much of the funding has come through the government of DRC from the Congo Basin Forest Fund (CBFF), with additional financing from IUCN and from USAID (the latter under the Central African Regional Program for the Environment, CARPE).

The DRC government has played multiple roles, not least of which was channeling funds to civil society partners and providing its support to the piloting of a market-oriented solution with a central role for a private sector partner. Integrating the project activities with existing government extension programs was also important, using local agronomists to support the establishment and maintenance of new plantings. According to the 'Shades of Green' terminological framework, the government's role has aspects of definer, funder, and promoter. The NGOs included in the initiative have been promoting sustainable land management and biodiversity conservation in the area for a long time. They play the role of regulators of natural resources, primarily through zoning and land-use planning, and of promoters via awareness raising, monitoring data, and media campaigns.

The market opportunity driving the initiative is demand for certified ecofriendly and organic shade-grown cocoa in international markets. Project partners are working with smallholder producers to prevent or reduce deforestation and pollution by promoting organic agroforestry systems that apply shade cocoa cultivation (in which cocoa seedlings are planted in the shade of native trees) on areas that

have not been converted from primary forest. The private sector partner, ESCO Kivu, had already promoted organic shade cocoa production in the east of the landscape, around the city of Beni. This initiative has sought to ensure that environmentally friendly approaches were adopted as cocoa cultivation spread westward into Mambasa Territory. Environmental outcomes sought for this initiative were (1) a reduction in the area of primary forest cut for agriculture and (2) lower greenhouse gas emissions. The social outcome sought was increased household income, based on strong cocoa production together with attractive pricing.

The government of DRC is promoting land-use planning and REDD+ as strategies to reduce deforestation countrywide. However, in this case, these strategies alone were not considered to be sufficient to attract farmers' interest, especially since at present no REDD+ payments for performance are available to the farmers. The main approaches selected to stimulate interest were technology transfer, awareness raising, and financial incentives.

Technology transfer and awareness raising are being achieved through a three-part program involving (1) a capacity-building program developed by ESCO Kivu to train producers in ecofriendly techniques, (2) awareness outreach by WCS and WWF in sensitizing farmers about deforestation, pollution, and climate change and in assisting communities to map out suitable production zones near their villages, and (3) agronomic assistance direct to farmers from government extension services.

The first financial incentive is that cocoa seedlings are provided to participating farmers to lower investment barriers. The second and more important incentive is that individual producers receive a premium price for their cocoa beans if they sign an agreement with the company to abide by specific production standards

that comply with international certification criteria. Compliance with the criteria is audited by a third party.

The certification scheme involves three main environmental rules, including the sole use of secondary forests (or preexisting farmland or fallows), avoidance of burning during field preparation or maintenance, and planting cocoa under the shade of native trees. It is also important to avoid pesticide use, but producers do not usually use pesticides anyway in this system so this requires little effort to achieve. Secondary forests are low biomass forests dominated by fast-growing and light-loving species (*Albizia*, *Macaranga*, etc.), and they are generally localized along the main roads or near villages. The no-burn rule implies that fire is not used during the farming process, thus reducing soil degradation and carbon emissions. Shade trees contribute to increased carbon storage and provide habitat for wildlife. In addition, cocoa produced under the shade is considered to be of better quality and requires fewer inputs.

So far, 18,000 farmers are participating in certified cocoa production across the whole of eastern DRC, many of them in Mambasa Territory, and their production has been successfully certified under organic/environment-friendly standards such as UTZ. The certified cocoa is sold to international companies such as Original Beans in the Netherlands. Detailed assessments of the livelihood benefits and impacts on deforestation in the landscape are now being developed. However, general compliance with the environmental rules has been good as shown by the certification audits. Furthermore, discussions with farmers (and the fact that new participants have been attracted by the success of early adopters) show that high and relatively stable income from cocoa is allowing more households to plan with some certainty important projects such as

paying for children's education, building more durable homes, and so forth. Small producers are also organizing themselves into cooperatives that can negotiate for even better prices.

ANALYSIS AND LESSONS LEARNED

Overview

Early indications are that the model works well in many ways—in particular that it is founded on a strong economic and business model with rapid smallholder uptake. However, it is too early to say unequivocally that the project has achieved its broader objectives—this will have to await more detailed results of environmental and livelihood monitoring. The lessons of the pilot project will attain much broader resonance through the links to the national REDD+ readiness program, which will provide resources and policy support to promote scaling-up on approaches proven to reduce deforestation, especially if they can improve livelihoods at the same time. The approach is also likely to be applicable in adjacent countries.

Notable Features and Success Factors

- Financial incentives and capacity building through awareness raising secured voluntary involvement of smallholders, who are the main actors of forest destruction in the area. Financial incentives had to be strong to secure farmer buy-in, in a context where law enforcement is lax. The approach tries to reconcile environmental concerns with the welfare of local populations.
- Holistic approach—the intervention had multiple elements, including economic assessments, technical capacity building, environmental awareness raising, practical assistance with mapping production zones, and attention to constraints in the marketing chain. No one element on its own would have had the desired outcome.

- Institutional arrangements—the various players were brought together based on their respective strengths. As a private economic operator, ESCO Kivu provided the market for cocoa, while international NGOs (WCS and WWF) focused on environmental aspects. The government provided financing through the CBFF, as well as expertise from the local agronomists.
 - The partnership between international NGOs and the private sector, whose relationships are commonly dominated by mistrust and suspicion due to opposing interests, was notable.
 - ESCO Kivu is by far the most important cocoa buyer in the area, accounting for approximately 92 percent of cocoa export. If there were other big buyers, the premium paid for certified cocoa might not have been enough to convince people to adopt the environmentally-friendly production techniques used in this initiative.
 - The government of DRC does not have a reputation for good governance. Yet, the role it played in this initiative as funder and promoter was notable, especially the channeling of ‘public’ funds to international NGOs. The partnership between the government and NGOs encouraged the involvement of the private sector and local farmers. Government agronomists were trusted by the local population, who as a result accepted more rapidly the new agricultural techniques proposed by the initiative.
- cassava, plantain, etc.) for income in the 3-4 years before cocoa trees begin to yield, so they were reluctant to leave many shade trees when they first prepared their fields. They were also reluctant to bother with planting shade trees later, but more and more are now seeing the advantage of doing so to attract the additional price premium this commands. To lower the investment barriers, seedlings of fast-growing native trees are provided as part of the initiative, as are seeds of annual crops during the transition period.
- The project may face greater challenges in meeting certification requirements if demand for new land remains high as the supply of secondary forest dwindles and pressure on primary forest increases. This will be partly determined by patterns of immigration to the landscape and the initiative needs to develop techniques to address this concern. Additional emphasis needs to be placed on land-use planning and the systematic, criteria-based delimitation of acceptable cocoa farming areas with local communities.
 - Illegal buyers of cocoa have invaded the market, resulting in the tax burden being kept high for legal buyers, a disincentive for some farmers to follow environmental best practices (buyers who don’t pay taxes can pay an inflated per kilogram rate) and a disincentive for ESCO to invest heavily in future cocoa farm capacity building.

Implementation Challenges

- Social inertia posed challenges. Fire is customarily a key technique used for agriculture in the target area so it was not easy to convince smallholder producers to adopt the no-burn rule.
- Poor farmers need to plant light-demanding annual food crops (rice, maize,

Prospects for Scalability

- The initiative can probably be scaled-up in this location in its current form, as long as the longer-term land-use planning, immigration, and monitoring issues are resolved.
- One potential constraint is the total size of the market for certified cocoa. No constraint has been encountered yet,

but, if this is expected to become a limiting factor, it may be strategically important to work on demand-side issues as well.

- To replicate the initiative in other locations, it would be important to analyze carefully the local situation, and to allow a period of piloting, before making large investments. Cocoa plots take 3 to 4 years to begin generating revenues so it may take five years or more before the effectiveness of a pilot can begin to be judged.
- Long-term sustainability of the current model is highly dependent on a single private sector entity interested in ethically sourced products. Measures need to be taken to ensure that other ethical buyers are available in case the primary buyer withdraws, and also to ensure that competition with non-ethical buyers does not drive down standards.
- Globally, certified markets are a relatively small proportion of the total demand for most commodities and so there are limits on the scale at which they can be applied. Nonetheless, the evidence of this and other certified activities is that they are able to deliver incentives large enough to alter producer behavior, and that they can be applied on a scale large enough to make a significant difference in certain high-priority landscapes. Further consideration needs to be given to the targeting of such interventions, what can be done to enable them to attain the maximum feasible scale, what happens when the supply of certification-compliant land is exhausted, and what beneficial aspects of the production systems can potentially be promoted to a broader set of noncertified producers.

IBIS RICE: HELPING FARMERS AND PROTECTING WILDLIFE, CAMBODIA

Karen Nielsen, Ashish John, and Tom Clements

13

SUMMARY

Ibis Rice is a program encouraging communities to help protect wildlife in Cambodia. Remote communities living on or adjacent to protected areas agree to abide by conservation and land-use rules, and, through cooperatives, benefit from improved prices for their organically grown Cambodian fragrant rice.

BACKGROUND

As pressure on land resources in Cambodia increases, forest and wetland clearance is spreading at key conservation sites and in protected areas. One such site is the Northern Plains, where one of the most important assemblages of large mammals and water birds in Southeast Asia occurs. The Giant Ibis, Cambodia's National Bird, is found here; it is one of 50 endangered species that the Wildlife Conservation Society (WCS) is working with the Cambodian government to conserve in the landscape.

Initial conservation efforts in Cambodia in the 1990s focused on establishing protected areas (PAs). The PAs established at that time had virtually no infrastructure and a small number of poorly paid staff with limited capacity; these sites were effectively 'paper parks.' The broader Cambodian PA system was declared based on relatively little information and consequently excluded many areas of importance for biodiversity conservation. Under these conditions, PAs alone were not sufficient to achieve biodiversity conservation goals so models for working both inside and outside PAs were needed.

Many PAs in Cambodia are home to local

Location

Cambodia

Timeline

2008-present

Land Use

rice production

Partners

NGOs and government

Role of Government

regulator, enabler

communities who are very poor and heavily dependent upon the forest and surrounding areas for their livelihoods. These villagers have little incentive to abide by national laws, particularly those that protect wildlife and habitats in the forest estate. Successful conservation therefore depends on engaging local people through approaches that directly link local economic and social development to environmental conservation.

EVOLUTION OF THE INITIATIVE

In 2008, the WCS-Cambodia Program in partnership with the Cambodian Ministries of Environment and Agriculture, Forestry and Fisheries instituted a series of pilot programs for payments for environmental services (PES) as a complement to PA management. Among these was Ibis Rice®, a certified Wildlife Friendly™ product that involves village-based agricultural cooperatives that buy paddy rice at a premium price from farmers who agree

to abide by conservation rules and regulations, including wildlife protection, following an agreed land-use plan, and eschewing the use of chemicals.

Ibis Rice began in four villages inside two PAs in the Northern Plains of Cambodia: the 4,000 square kilometer Kulen Promtep Wildlife Sanctuary and 1,900 square kilometer Preah Vihear Protected Forest. Both PAs are occupied by or used by long-established communities that either cultivate lowland rainfed paddy rice or follow upland shifting cultivation for rice and other crops, while also collecting forest products and fishing. Forest resources are a crucial safety net for the livelihood of these rural poor, and provide cash income, particularly from the sale of liquid resins from Dipterocarp trees.

During the incubation phase of this project, a value chain study was done on rice grown in two typical villages in two protected areas, along with a baseline study that showed that farmers traditionally eschewed the use of chemicals for the simple reason that they were unaffordable. The project was initially based in Siem Reap, building on the enormous opportunity provided by the identified target market: the 2 million tourists who visit the temples at Angkor each year. In addition, a further innovation was to link Ibis Rice with the Wildlife Friendly™ product brand, which was globally launched at around that time. Market research conducted by WCS has indicated that a significant number of buyers, mainly up-market hotels and restaurants in Siem Reap, would be willing to pay a premium for Wildlife Friendly products, and this information fed into the creation of the brand and early marketing strategies.

Under Ibis Rice, farmers that keep to agreed land-use plans and follow rules including no-hunting are allowed to sell their rice through a village committee, known as the village marketing network (VMN).

Sansom Mlup Prey (SMP), a local NGO set up to market Ibis Rice, offers preferential prices to these farmers. This approach bypasses middlemen who previously monopolized village trade, suppressing prices and cheating on weights and measures. Payments to individual farmers are linked to monitoring by the VMN of compliance with the land-use plan and no-hunting rules:

1. No forest clearance for new paddy fields or expansion of paddy fields beyond 0.5 hectare without permission from the authorities;
2. Trapping or hunting of common species to protect crops is allowed;
3. Hunting for commercial purposes is not allowed; and
4. Hunting key threatened species is not allowed, for any purpose.

The VMN is also responsible for management of the land-use plans—with external verification by SMP and WCS. Compliance is measured by:

- Wildlife population status (should remain stable or increase);
- Number of nests and chicks of key species;
- MIST/SMART reports from patrol and biodiversity patrolling teams that show the number of land clearances/logging/hunting activities and patrolling effort;
- Measurement of paddy fields after sale of rice by VMN executive members and SMP staff; and
- Land clearance monitoring reports based on remote-sensing images.

SMP then organizes the processing, packaging, marketing, and sales of Ibis Rice. Rice is sold nationally in Cambodia, with supermarkets, restaurants, and large hotels the principal customers (see figure). All profits are shared between the farmers and the village organizations, after deducting the costs of SMP.

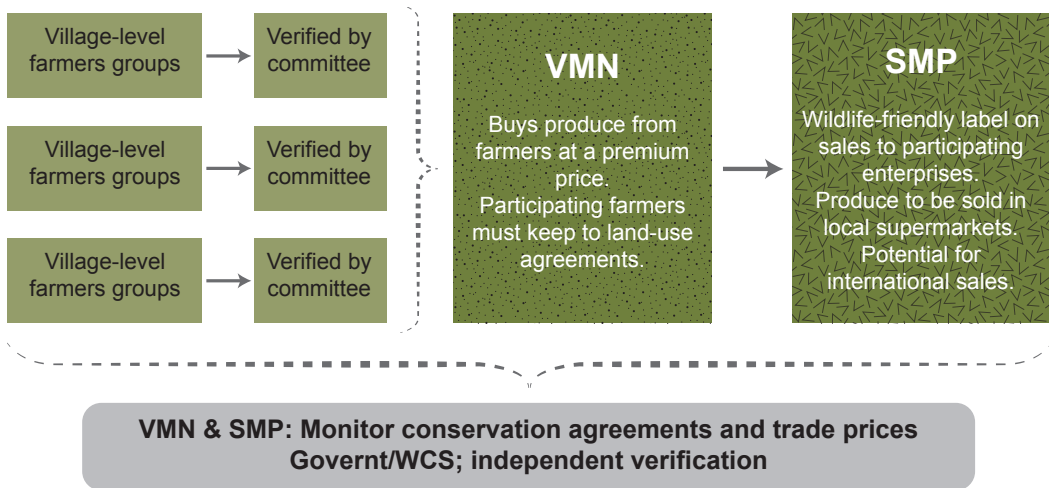


Figure 1. Ibis Rice institutional setup.

The Ibis Rice program has novel institutional arrangements: the village marketing network subcontracts to individual farmers. The village institutions—the local rules governing natural resource management—are nested in a multi-layered framework that includes:

- An external agency, Sansom Mlup Prey, that provides rewards by connecting the villages to national and international markets, certifies compliance, and helps to mediate conflicts;
- PA authorities, who can enforce environmental and forestry laws, supporting village institutions to resolve cases they are unable to solve internally or to remove outsiders; and
- External organizations, including SMP and WCS, that reinforce rules and can assist with resolving conflicts or other problems (such as talking to donors and higher government authorities).

Monitoring of compliance is conducted at all levels: local monitoring by VMN, certification by SMP, enforcement of national laws by the PA authorities, and external monitoring by WCS, the PA, and SMP. These arrangements build resilience and checks in the system, which make the programs more effective and sustainable.

The different teams have very different and unique roles in the project. Each team, however, monitors land clearance and hunting in its own way, which ensures the triangulation of findings and increases chances that things are not missed.

Socio-economic benefits: The number of households participating in the scheme has risen steadily from less than 20 in 2008–2009 to 339 in 2013–2014. In the latter year, more than 400 tons of rice was purchased at a premium price—some 8 to 12 percent over the prevailing market price at the farm gate. Ibis Rice provides other benefits that are less quantifiable: (1) it uses unbiased scales so weight is recorded more accurately than traders who it is estimated cheat on weights by 10 to 15 percent; (2) the VMN provides free seeds for new members and technical help to all; (3) the same variety, high-value fragrant rice, is grown by all farmers, which is worth more in the marketplace; (4) Ibis Rice pays each family that sold rice a dividend at a time of the year when the family is not getting income from rice; and (5) traders raise their prices to compete with Ibis Rice buyers, thus benefiting all rice growers in the village.

Environmental benefits: In 2013, household compliance with the key criterion

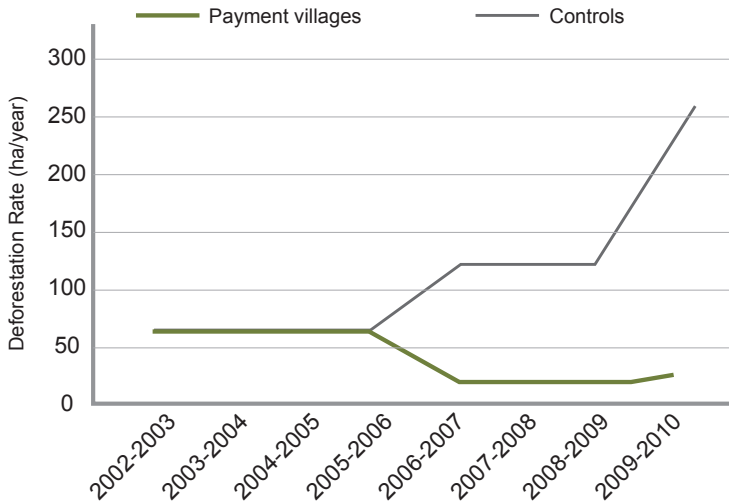


Figure 2. Environmental benefits of Ibis Rice and ecotourism.

(forest clearance of new fields) was greater than 90 percent. In the communities where WCS and partners undertook Ibis Rice and ecotourism (not discussed here) payment programs, the decrease in habitat clearance rates was about 50 percent in comparison with matched controls (see Figure 2).

ANALYSIS AND LESSONS LEARNED

A number of factors contributing to the project's success can be discerned. For example:

- An innovative aspect was the direct link between the product sold and positive conservation outcomes; farmers get a better price for their product if they help conserve wildlife by obeying the land-use plans and not hunting. A new market and unique brand was created.
- Rules were not imposed but standards were presented to the farmers. They had to decide whether they wanted to abide by those standards in order to receive a premium. The approach was thus highly participatory.
- The land-use plans providing tenure security and recognition by authorities were the foundation on which to build

the project. Laws, legal procedures, and the role of authorities were important institutional arrangements that had to be put in place.

- Legal recognition from government (Protected Area Authorities) that the village land-use committee had the right to monitor land clearance and be part of village-level decision making on land distribution was very important.
- Improving the political influence of the committee in village decision making helped the process of institutionalizing activities in village procedures. Helping committee members develop skills to make astute political decisions in the village proved to be important. They are not seen as a threat by existing authorities but act as an important addition to the village administrative structure.
- Working with and through government authorities was key to providing institutional support for quasi-legal agreements.

Nevertheless, multiple challenges were encountered during project implementation. For example:

- Cambodian villages have lived in stress and distrust during decades of conflict.

Rebuilding trust and respect for authorities and government procedures takes time. It is important that the community see government officials as part of the 'support team' that is trying to provide it with assistance. Being a conservation agency supporting enforcement, this becomes difficult, but raising the community's awareness that the laws are applied impartially and understanding that this is not done with prejudice helps improve community understanding of the roles of the different teams.

- Government decisions that are made for short-term political or financial gains distort the legal framework and laws. This makes it hard to convince the community that the government is trying to help it. One example is the issue of land concessions to investors in community user areas.
- The project requires the purchase of large amounts of paddy in each village to reach more families. A limiting factor was the amount of capital available to SMP or WCS to buy rice. It is important to have this capital in hand so that there are no delays or breaks during procurement.
- The activities are implemented in protected areas where there are third-party monitors, such as park rangers and research rangers, who monitor biodiversity and illegal activities. Replicating the approach in other locations where such assets are not available would be challenging.

CERTIFIED SUSTAINABLE TEA PRODUCTION IN TANZANIA'S SOUTHERN HIGHLANDS

Filbert Y. Kavia

14

SUMMARY

The three major tea companies in Tanzania, Mufindi Tea and Coffee Ltd. (MTC), Wakulima Tea Company (WATCO), and Unilever Tea Tanzania Ltd. (UTT), worked closely with local government, the Rainforest Alliance, and smallholder organizations to transform tea production practices in order to mitigate environmental risks, while raising productivity and market competitiveness. This effort led to the adoption of Rainforest Alliance standards by thousands of smallholder tea farmers.

BACKGROUND

Tea (*Camelia sinensis*) has been grown and produced on commercial estates and by smallholders in Tanzania since 1967. Tea cultivation in Tanzania has had adverse environmental impacts. Tea is monocropped in the major producing districts—Mufindi and Rungwe. During the early 1990s, biodiversity rich forests were cleared and natural water flows were altered to make way for tea plantations and expanded smallholder plantings. This process contributed to the loss of wetland habitats, soil erosion and the polluting of rivers and irrigation reservoirs. Parallel actions involved illegal logging and hunting, the gathering of forest products, horticultural cultivation on riverine and valley bottom wetlands, livestock grazing, charcoal burning, and seasonal bush fires, posing major threats to the natural ecosystems of both districts.

Tea plantations and tea gardens occupy more than 6,000 hectares in Mufindi and Rungwe, which together account for more than 50 percent of national production.

Location

Tanzania (Rungwe and Mufindi districts)

Timeline

2008 to present

Land Use

tea production

Partners

public agencies, private companies, NGOs

Role of Government

enabler

More than 30,000 smallholder farm households cultivate tea in Tanzania, about two-thirds of which are located in these two districts.

EVOLUTION OF THE INITIATIVE

In early 2007, MTC and UTT, in response to international market demand for sustainable products, launched efforts to conserve biodiversity and ensure sustainable livelihoods by transforming tea production practices. Their efforts addressed a range of environmental, economic, and social risks, including water pollution, soil erosion, and wildlife conservation. By 2008, all three companies certified their estates under Rainforest Alliance (RA) standards. While reducing their environmental footprint, these estates began receiving higher prices for their certified tea in international markets.

These early results stimulated wider

interest within the industry to adopt green agricultural practices. WATCO, a joint venture between Tanzania Tea Packers Ltd and an association of smallholder farmers, began to support smallholder farmers to shift their practices and attain the RA standard. MTC and UTT followed suit, working with their smallholder outgrowers to apply good agricultural practices. In addition to the three companies, multiple other entities have been involved in this process. These have included:

- The Rainforest Alliance, which has provided training on RA principles and criteria for both smallholders and large-scale farmers in training of trainers;
- The Tanzania Smallholder Tea Development Agency, which has provided support in organizing farmers into groups and associations, providing extension services, and training farmers on good agricultural practices;
- The Tea Research Institute of Tanzania (TRIT) has provided new technologies and mainly contracts with private factories for training of smallholder groups and on RA criteria;
- Local government authorities, improving infrastructure, especially feeder roads into tea farms, and participatory natural forest and water catchment area protection;
- The Tanzania Smallholders Tea Growers Association is an umbrella association of 16 registered Tea Smallholders Associations for advocating smallholders' interests and welfare. It serves as an entry point for promoting sustainable tea production among smallholder farmers;
- The Tea Association of Tanzania plays a crucial role in facilitating access of smallholders' greenleaf to export markets; and
- The Tanzania Forest Conservation Group in Mufindi District and Rungwe Environment Conservation and Tourism Group in Rungwe district both worked with

smallholder tea farmers through their association to promote conservation and restoration of forest biodiversity through participatory forest management, environmental education, community development, and advocacy of sustainable production.

The certification of smallholders started with RA providing training for tea company management and extension staffs, and a small number of farmers that are identified as having above-average tea management capacity—lead farmers. Lead farmers, with support from the Tea Research Institute of Tanzania extension staff, volunteer to help train their fellow farmers and prepare them for the RA audit. The objective of this model is to have RA training reach every farmer through other farmers, with emphasis placed on integrated pest management, soil conservation, and integrated waste management.

To address the risks associated with pesticide applications, WATCO formed groups of a few farmers as agrochemical applicators at the village level, and the individuals in the group undergo a medical checkup at the expense of WATCO. Agrochemicals applicators are responsible for the application of all agrochemicals in the respective village and they are paid by the individual farmer. In order to meet the principles and criteria of RA for handling agrochemicals, a store of agrochemicals was built in the village on the premises of one of the farmers who was ready to allocate an area for the store. Personal protective equipment, which is the most expensive, was supplied to each applicator in the village by WATCO and was subsidized by other donors. To make sure the applicators passed the RA audit, the company internal management systems, where the internal audits are done using the lead farmers under TRIT extension staff supervision, which is done three times a year before the RA external audits.

In Mufindi District, where UTT and MTC operate four factories and nine estates, the two companies sought to emulate WATCO's experience and, in 2012, they started engaging smallholder farmers in an effort to help them implement RA standards. The companies in cooperation with RA have finished training lead farmers of the district's 24 farmer organizations with support from the Tea Research Institute, Smallholder Tea Development Agency and the local government authority. Through this initiative, the Tanzania Forest Conservation Group is also working on training farmers on the conservation and restoration of forest biodiversity.

RA certification of small farmers has advanced well over time. A first cadre of 11,900 small farmers in Rungwe was certified (under WATCO) in 2010. These farmers represented 80 percent of the 15,000 farmers in that district. In Mufindi, some 200 medium scale growers have been certified under UTT, while some 1,600 smallholders are under the process of conversion and certification (under UTT or MTC). In another district, Njombe, nearly 2,700 farmers (of the 3,500 total there) were recently RA certified (April 2014).

Positive results are emerging from these

efforts. For example, in Mufindi, UTT and MTC have protected nearly 8,200 hectares of natural forest containing several endangered species. Moreover, the local government authority of the Mufindi District council preserved 3,126 hectares of natural forest with endangered species of mammals, birds, reptiles, and amphibians. Endangered species such as monkeys (Nyani), forest francolin (Kwale), crowned hornbill (hondohondo), and little egret (yangey-ange) are more commonly seen in the protected forest areas.

Farmers have benefitted both from productivity gains and the higher prices they received for green leaf from certified farms. Reduced pesticide spraying has also improved worker safety and community health. Productivity gains can be observed by contrasting the yield patterns in Mufindi and Rungwe with those in Tanzania's other tea producing districts. The latter tend to have less favorable weather and other growing conditions so direct comparisons in the level of yields is not valid. Yet comparisons in the recent trends in yields are telling. In the two 'innovation' districts, average smallholder yields have increased from 1,182 kilograms/hectare in 2010 to 1,360 kilograms/hectare in 2013,

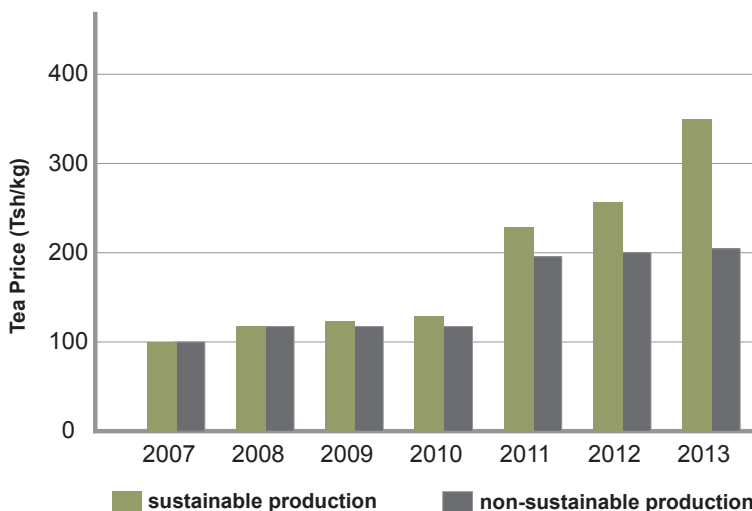


Figure 1. Comparative greenleaf prices paid (Tanzanian shillings/kilogram)

with incremental gains each year. In contrast, yields in the non-innovation districts have been unstable and were substantially lower in 2012 and 2013 than in 2010. The figure illustrates that farmers involved in sustainable production schemes are obtaining higher prices than conventional growers, in large part due to the improved quality of their leaf.

ANALYSIS AND LESSONS LEARNED

Several lessons can be drawn from Tanzania's smallholder tea experience. For example:

- The market stimulus—i.e. the demand for tea from sustainable sources—played an important catalytic role in Tanzania's experience. The leading companies sought to accompany or be ahead of this curve, rather than find their Tanzanian tea in a disadvantaged position.
- The initial move by the leading companies to adopt sustainable practices on their own estates helped to inform and speed up the process by which smallholder producers, including their outgrowers, could adopt improved practices and gain RA certification. Some companies already had strong links with smallholders while others needed to work closely with farmer organizations to lay the basis for the supported shift to sustainable agricultural practices.
- The close coordination between the government and the tea companies was also important in this process. While sustainable practices by smallholders couldn't be regulated into effect, several government agencies played key enabling roles, including technical and administrative support.
- Involving stakeholders in designing and implementing innovation is crucial as this enables easy adoption and implementation of an innovation. However, a participatory model requires careful

design that ensures that various stakeholders play complementary roles.

The involvement of stakeholders in the process of innovation facilitates the communication of credible information to government institutions, and acts as a catalyst in drawing other stakeholders' attention outside the tea subsector on the innovation. The stakeholders are therefore more motivated to value the innovation positively.

It is important that smallholders understand and realize the (financial) benefits of green agriculture; otherwise, there is no guarantee that they will maintain their sustainable agricultural practices or not otherwise protect the surrounding environment. In Tanzania, improvements in productivity and the higher prices for higher quality, certified tea were key to the successful expansion of certification.

WHILE CONTRIBUTING TO ECONOMIC AND INCOME GROWTH, COMMERCIAL AGRICULTURE HAS SOMETIMES CONTRIBUTED TO THE DEGRADATION OF ECOSYSTEM SERVICES, INCLUDING DEFORESTATION, BIODIVERSITY LOSS, WETLANDS DESTRUCTION, LAND DEGRADATION, WATER POLLUTION AND DEPLETION OF AQUIFERS. THESE IMPACTS ARE NOT INEVITABLE AND THERE ARE A WIDE RANGE OF INSTRUMENTS WHICH CAN AND ARE BEING USED TO REDUCE AGRICULTURE'S ENVIRONMENTAL FOOTPRINT. SHADES OF GREEN IS A COLLECTION SHORT CASE STUDIES HIGHLIGHTING RECENT OR ON-GOING EFFORTS TO ADDRESS THIS CHALLENGE. THE AUTHORS HAVE SOUGHT TO HIGHLIGHT IMPORTANT LESSONS FOR PUBLIC POLICY. IT IS THE EDITORS' HOPE THAT THIS VOLUME OFFERS CLEARER INSIGHT INTO THE ROLES FOR GOVERNMENT AND THE OPPORTUNITIES FOR DEVELOPMENT ORGANIZATIONS TO HELP MAKE COMMERCIAL AGRICULTURE SUSTAINABLE IN EMERGING COUNTRIES.