BOOK REVIEW

Addressing the Climate Change Debate in Agriculture

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Lipper, Leslie, McCarthy, Nancy, Zilberman, David, Asfaw, Solomon, and Branca, Giacomo (eds.) (2017), *Climate Smart Agriculture: Building Resilience to Climate Change*, Springer, Cham, 629 pages, €51.99 (print edition).

The Climate-Smart Agriculture Debate

Climate-smart agriculture (CSA) is a term that was put forward by the Food and Agriculture Organisation (FAO) to describe the gamut of measures undertaken in response to the impact of climate change on agriculture and food production (FAO 2009). CSA has three broad components: (1) improving agricultural productivity and incomes, (2) strengthening climate adaptation and resilience, and (3) reducing greenhouse gas emissions in agriculture (FAO 2013).

An integral part of the CSA framework is to develop indicators to assess the "climate smartness" of agricultural policy in a given region. International organisations, including the World Bank, the Consultative Group on International Agricultural Research (CGIAR), and the Research Programme on Climate Change, Agriculture, and Food Security (CCAFS) have converted the CSA framework into a set of indicators to evaluate agricultural policy responses to climate change (Braimoh *et al.* 2016). The indicators thus developed give scores to climate preparedness in policy (including climate mitigation in agriculture), technology and infrastructure use, and farming practices. With respect to farming practices, these indicators give a positive score to the establishment of large-scale agribusinesses within a region.

CSA has emerged as a policy framework that is championed by a whole host of inter-governmental agencies and organisations, including FAO, the International Fund for Agricultural Development (IFAD), and the United Nations Environment Programme (UNEP), as one that can address concerns of livelihood, food security,

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development, and the conditions of small farmers in agriculture.[1] International associations such as the World Business Council for Sustainable Development (WBCSD) have argued that CSA can be a platform to promote low-carbon technologies in agriculture (mitigation) and address sustainable production in agriculture (Vermeulen and Frid-Nielson 2017). Since its first use in 2009, CSA has become a catch-all method to address all policy concerns pertaining to agriculture and climate change.[2]

This rise of CSA as an international frame of reference serves as background to the volume under review. The editors and contributors – among them are agricultural and natural resource economists and policy experts from governmental, academic, inter-governmental, and private institutions – address conceptual and policy-based aspects of CSA. The volume aims to be a comprehensive guideline to CSA for development agencies, practitioners, policy makers, non-governmental organisations, academics, and for the private sector.

The edited volume consists of 6 parts and 25 chapters. It begins with an overview and history of CSA and its features (part 1, chapters 1 to 3). It then seeks to link CSA to concepts in the climate change literature, including the concepts of resilience, adaptive capacity, innovation, and technology adoption. Parts 2 to 5 (chapters 4 to 23) describe, by means of a series of case studies, practices and policy measures under the CSA framework, including an assessment of vulnerability and adaptive capacity within agriculture at different levels. The final section (part 6, chapters 24 and 25) provides a synthesis and review of the CSA project and discusses the way forward.

CSA Agenda on Mitigation, Finance, and Innovation

The acceptance of CSA and the formation of the Global Alliance for CSA (by FAO, World Bank, and CGIAR) were opposed by many academics, activists, and transnational NGOs, including ActionAid, Oxfam, and Greenpeace, on three grounds.[3] The first criticism was that CSA's emphasis on climate mitigation in agriculture poses an unfair burden on developing countries and compromises their developmental rights.[4] The second criticism was that CSA privileged private agribusinesses (effectively greenwashing them) at the expense of small farmers and

[1] Available at https://www.theguardian.com/global-development-professionals-network/2014/oct/17/climate-change-agriculture-bad-isnt-good, viewed on August 5, 2019.

[2] Although not part of the decisions or agendas of various Conference of Party discussions on Climate Change, principles of CSA are being pushed outside of the UNFCCC as well as within the Koronivia Joint Work on Agriculture (KJWA) that was reached at COP23 in November 2017, available at https://ccafs.cgiar.org/blog/climate-and-agriculture-cop24-depressing-or-exhilarating#.XO8r98gzbIU, viewed on August 5, 2019.

[3] In an open letter, various organisations, including Oxfam, ActionAid, Third World Network, and Greenpeace called out the CSA platform and raised concerns about the nature of the Global Alliance for CSA (http://www.climatesmartagconcerns.info/english.html).

[4] ActionAid (2011); Neufeldt *et al.* (2013).

food security.[5] The third criticism was that that the policy itself and the parameters used to measure it were vague, and critics asked, in this context, what was new about CSA (ActionAid 2014).[6]

Chapter 2 of the volume (by the editors, Lipper and Zilberman) addresses these criticisms. On the potential of reducing greenhouse gas (GHG) emissions from agriculture, the authors argue that the CSA relied on the 4th assessment report of the Intergovernmental Panel on Climate Change (IPCC) (Smith *et al.* 2008), stating that there is an "estimated global economic mitigation potential for 2030 from agriculture of 1500–1600, 2500–2700, and 4000–4300 MtCO2-eq/year at carbon prices of up to 20, 50, and 100 US$/tCO2-eq." This potential is based on the use of carbon sequestration techniques in "cultivated organic soils, cropland management, grazing land management, restoration of degraded lands, rice management and livestock." It must be pointed out that GHG emissions in agriculture alone are less than emissions from sectors such as industry, power generation, and transportation. And it is in the latter three sectors that there is greater potential for mitigation of GHG emissions. However, many large-scale studies have pointed out the inadequacy (in terms of mitigation) and inefficacy (in terms of financial feasibility) of sequestration techniques (Rochon *et al.* 2008; Venton 2016; Faran and Olsson 2018).

The authors write that greenwashing agribusiness was not a goal of CSA practices. They write that, at the inception of the CSA framework, carbon offsets and trading mechanisms, such as Clean Development Mechanism (CDM) and the United Nations collaborative programme on Reducing Emissions from Deforestation and Forest Degradation in Developing countries (REDD+), were the only viable sources of global climate finance to implement mitigation and adaptation efforts in agriculture. They further argue that, subsequent to the Paris Agreement and the failure of carbon trading mechanisms, the principles of CSA can just as easily be achieved by public and private financing of adaptation and mitigation efforts (including cash transfers and/or other non-carbon offset mechanisms).

On the criticism that CSA did not have anything new to offer, the chapter argues that CSA was never "intended to provide a new set of sustainability principles, but [was] rather a means of integrating the specificities of adaptation and mitigation into sustainable agricultural development policies, programmes, and investments" (p. 24). It further describes CSA as a non-prescriptive "tool to identify locally

[5] This refers to a wide range of concerns from the promotion of GMO technology to the implementation of market mechanisms under the CSA framework (Taylor 2018).

[6] The ActionAid report (ActionAid 2011) actually states that "The concept of 'Climate-smart agriculture' was developed by the FAO and the World Bank, claiming that 'triple wins' in agriculture could be achieved in mitigation (reducing greenhouse gas emissions), adaptation (supporting crops to grow in changing climate conditions), and increasing crop yields. But there is growing confusion and debate over what the term really means, what it can achieve, what is new about it, and whether it really can benefit food systems in the face of climate change," available at https://actionaid.org/sites/default/files/csag_clevernamelosinggame_0.pdf, viewed on August 5, 2019.

appropriate solutions to managing agriculture for sustainable development and food security under climate change" (p. 26).

Chapter 3 of the book reaffirms the arguments in Chapter 2, and describes the combined benefits of reducing greenhouse gases and improving food security and farm-level incomes. Chapter 4 of the book, by Zilberman, Lipper, McCarthy, and Gordon, deals with the importance of innovation in agriculture when negotiating the impact of climate change.[7] In this context, the authors take a strong view in favour of adopting new farming practices (including GMOs and intensive cultivation techniques):

> While environmental groups are among the most concerned about climate change, and were on the forefront of developing mechanisms to finance mitigation, sometimes they may oppose many innovative technologies and institutions that may be part of the solution to the challenges of climate change. This cautious response is not surprising because the traditional instinct of such groups is to protect and conserve.

Climate-Smart Agriculture: Old Wine in a New Bottle?

Some of the most interesting and useful sections of the book deal with the integration of the concepts of vulnerability and resilience (chapters 5 to 7), and present different case studies on the assessment of climate risks (chapters 8 and 13). The differential impact of average temperature rise on different cropping systems are reported. Chapter 8 uses crop modelling techniques to estimate that rising average temperatures will have a negative effect on US maize yield growth. Chapter 6 examines the effects of average (including night-time and day-time extremes) temperatures on rice production in Laos.

A welcome feature of this book is that several chapters examine models and tools for assessment of farm-level impact of climate variability and climate shocks in agriculture. These include chapters on the use of satellite information for crop yield production (chapter 5), understanding trade-offs between implementing CSA practices and their impact on farm-level production and farm incomes (chapter 8), and the use of AgMIP regional integrated assessment methods to evaluate vulnerability, resilience, and adaptive capacity for CSA (chapter 13).

An important characteristic of the CSA framework is that it promises to be a novel approach towards questions of climate adaptation and resilience in agriculture. This view is premised on case studies of CSA practices across Africa and parts of Southeast Asia. However, upon closer examination, there is not much to distinguish CSA practices from existing coping strategies. For instance, chapter 7 on "Farmers' Perceptions of and Adaptations to Climate Change in Southeast Asia" states that

[7] The opposition to genetically modified organisms (GMOs), especially in light of its potential to address abiotic stresses, has baffled most experts (Rao *et al.* 2018; National Academies of Sciences, Engineering, and Medicine 2016).

adaptation strategies undertaken by farmers are a consequence of the way they perceive climate change. This assessment is only partially correct, since it ignores, first, the unprecedented nature of the impact of climate change on agriculture, changes that are not part of any present or historical repository of cultural practices or knowledge that farmers possess. Secondly, it ignores the fact that the adoption of new technology in agriculture by farmers depends on the presence of multiple factors, including extension services, research in agricultural science, and, very importantly, the socio-economic conditions of farmers adopting these practices. Chapter 10 of the book looks at the role of cash transfers in promoting household resilience in Zambia, and chapter 11 investigates the role of input subsidy programmes in promoting CSA in sub-Saharan Africa. The former chapter deals with the potential of cash transfers to mitigate risks for small farmers by explicitly accounting for climate risks. The latter chapter concludes that there may be potential for input subsidy programmes to "promote system-wide investments that are both climate-smart and market-smart and synergistic in their promotion of community resilience to climate variability." Both these conclusions, again, do not distinguish CSA as a framework separate from the wealth of literature on risk, uncertainty, and decision-making in agriculture (Lipton and Sinha 1999).

Chapter 15 on "Climate Smart Food Supply Chains in Developing Countries," written by Thomas Reardon and David Zilberman, looks at the risks posed by climate shocks across the food supply chain, and their implications for food security and farm-level incomes. Chapter 16, on the adoption of climate-smart agriculture (by Jamie Mullins, Joshua Graff Zivin, Andrea Cattaneo, Adriana Paolantonio, and Romina Cavatassi), underscores the importance of extension programmes in implementing rain-indexed crop insurance schemes. Risk assessments in developing countries such as India are moving in this direction (NABARD 2012). Chapter 20 looks at "Improving the Resilience of Central Asian Agriculture," and concludes that access to markets and extension services is a driving factor in the adoption of CSA technologies, and that the adoption rate in this regard is higher for rich households than poor households. Chapter 21 on "Managing Environmental Risk in Presence of Climate Change" in the Nile basin of Ethiopia finds that past adaptation to climate change "reduces current downside risk exposure, and so the risk of crop failure." However, this is an assessment of the impact of climate variability, rather than climate change, on yields. Chapter 22 discusses diversification as a CSA strategy amongst farmers in Zambia and Malawi. It indicates that there is a relation between extension service availability and diversification strategies adopted by farmers. These chapters are in congruence with existing literature on technological adoption, risk mitigation, and decision-making in agriculture (Wildavksy 1979; Ruttan and Hayami 1973; Hayami and Ruttan 1970; Olmstead and Rhode 1993; Just 2003). However, they do not comment on the constraints on scaling up these measures, a point relevant to small farmers constrained by social and economic factors.

The threat of climate change is unprecedented. Can the CSA framework address this? On this count, the volume leaves a few questions unanswered. My first concern is that by emphasising climate mitigation, the book unwittingly pushes the door open for treating climate mitigation at par with climate adaptation in the case of agriculture.[8] The net result is that policy advocacy for mitigation in agriculture will be strengthened by this framework. At the same time, the CSA framework does not place the burden of GHG mitigation on developed countries via reduction of fossil fuel use in agriculture. On the contrary, transnational corporations such as Walmart and McDonalds have used CSA to develop sustainability indicators to evaluate positively and promote their production chains.[9] A possible outcome of placing the mitigation burden on developing countries is that unproven technologies for mitigation in agriculture in the developing world (such as carbon sequestration) will be seen as potential offsets for mitigation efforts in the developed world. National governments of the United States and Denmark have stated that CSA should be used as a basis for intervention, technology transfer, and finance, premised on carbon offsets and carbon trading mechanisms (particularly in Africa).[10] Despite uncertainty regarding the prospects of climate mitigation in agriculture (and indeed, forestry and land-use change), some low-income developing countries (including Ethiopia) that are largely dependent on agriculture already seem to have given up their potential for improving agricultural production and industrial production by committing to a carbon-neutral economy.[11]

My second concern is that CSA as an approach fails to incorporate climate variability. Though many individual chapters in the volume assess the risk of short-term climate variability and the strategies used to adapt to it, its importance for agricultural policy in developing countries is not an inherent feature of the CSA framework. This is because the CSA framework conflates current climate variability and future climate change, a distinction recognised by some climate scientists and agricultural economists but often ignored by policy makers. In ignoring this distinction, the research agenda fails to distinguish the current impact of climate variability from the long-term effects of climate change in agriculture (across differing cropping systems and agro-climatic conditions). This error has significance for developing countries, since it affects vulnerability assessments, the identification of short-term climate risks, and the identification of measures for alleviating these associated risks. Thus CSA, like other climate policies in agriculture, "runs the risk of over-emphasising the environmental

[8] Unwitting because it provides caveats for the role of mitigation in agriculture-technological capacities, institutional factors, and trade-offs with agricultural production.

[9] Available at https://corporate.walmart.com/newsroom/2014/10/06/walmart-announces-new-commitment-to-a-sustainable-food-system-at-global-milestone-meeting, viewed on August 5, 2019.

[10] The official correspondence and remarks of the US Whitehouse on climate-smart agriculture is available at https://obamawhitehouse.archives.gov/the-press-office/2014/09/23/remarks-president-un-climate-change-summit, viewed on August 5, 2019.

[11] Available at https://climateactiontracker.org/countries/ethiopia/2018-04-30/, viewed on August 5, 2019.

and climatic constraints on agricultural production in the present, while ignoring the role of socio-economic factors as significant barriers to agricultural growth" (Jayaraman and Murari 2014).

My third concern is that the CSA framework ignores the question of socio-economic relations within agriculture. The conclusions and assessments in the chapters on CSA management practices and adaptation techniques, for example, may be applicable to certain specific contexts, but by claiming that these support CSA practices in general, the volume fails to address important issues affecting agriculture in the developing world. These include infrastructure (and other support) in agriculture and the socio-economic conditions of small farmers that make them vulnerable to risks in general and climate risks in particular. Agriculture in developing countries is dependent on several non-price factors. The role of input subsidies, insurance, and other price support systems, while beneficial to farmers, may be inadequate in the absence of public finance and support with regard to credit availability, infrastructure, irrigation, extension services, and marketing (Ramakumar 2012). Further, small farmers face a series of constraints on improving productivity and incomes on account of the small scale of production, resulting often in low and negative farm incomes (Swaminathan and Baksi 2017).

References

ActionAid (2011), "Fiddling with Carbon Markets While Africa Burns," ActionAid, Johannesburg, available at https://actionaid.org/publications/2011/fiddling-soil-carbon-markets-while-africa-burns, viewed on June 7, 2019.

ActionAid (2014), "Clever Name, Losing Game? How Climate Smart Agriculture is Sowing Confusion in the Food Movement," ActionAid International, September, available at https://actionaid.org/sites/default/files/csag_clevernamelosinggame_0.pdf, viewed on May 31, 2019.

Braimoh, Ademola, Emenanjo, Ijeoma, Rawlins, Maurice Andres, Heumesser, Christine, and Zhao, Yuxuan (2016), "Climate-smart Agriculture Indicators," World Bank Group, Washington, D.C., available at http://documents.worldbank.org/curated/en/187151469504088937/Climate-smart-agriculture-indicators, viewed on May 31, 2019.

Faran, Turaj S., and Olsson, Lennart (2018), "Geoengineering: Neither Economical, nor Ethical: A Risk-Reward Nexus Analysis of Carbon Dioxide Removal," *International Environmental Agreements: Politics, Law and Economics*, vol. 18, no. 1, pp. 63–77.

Food and Agriculture Organisation (FAO) (2009), "Food Security and Agricultural Mitigation in Developing Countries: Options for Capturing Synergies," Food and Agriculture Organisation of the United Nations, Rome, October, available at http://www.fao.org/docrep/012/i1318e/i1318e00.pdf, viewed on June 7, 2019.

Food and Agriculture Organisation (FAO) (2013), *Climate-Smart Agriculture*: *Sourcebook*, Food and Agriculture Organisation of the United Nations, Rome.

Hayami, Yujiro, and Ruttan, V. W. (1970), "Factor Prices and Technical Change in Agricultural Development: The United States and Japan, 1880–1960," *Journal of Political Economy,* vol. 78, no. 5, September, pp. 1115–41.

Jayaraman, T., and Murari, Kamal (2014), "Climate Change and Agriculture: Current and Future Trends, and Implications for India," *Review of Agrarian Studies*, vol. 4, no. 1, pp. 1–49.

Just, Richard (2003), "Risk Research in Agricultural Economics: Opportunities and Challenges for the Next Twenty-five Years," *Agricultural Systems*, vol. 75, nos. 2 and 3, pp. 123–59.

Lipton, Michael, and Sinha, Saurabh (1999), "Damaging Fluctuations, Risk, and Poverty: A Review," Background Paper for the World Development Report 2000/2001, Poverty Research Unit, University of Sussex, Brighton, October.

National Academies of Sciences, Engineering, and Medicine (2016), *Genetically Engineered Crops: Experiences and Prospects*, The National Academies Press, Washington D.C.

National Bank for Agriculture and Rural Development (NABARD) (2012), "Risks, Vulnerability and Coping Mechanism by Agricultural Households in Dryland Areas in Karnataka," *Evaluation Study Series*: *Karnataka*, no. 18, National Bank For Agriculture and Rural Development, Bengaluru.

Neufeldt, Henry, Jahn, Molly, Campbell, Bruce M., Beddington, John R., DeClerck, Fabrice, De Pinto, Alessandro, Gulledge, Jay, Hellin, Jonathan, Herrero, Mario, Jarvis, Andy, LeZaks, David, Meinke, Holger, Rosenstock, Todd, Scholes, Mary, Scholes, Robert , Vermeulen, Sonja, Wollenberg, Eva, and Zougmoré, Robert (2013), "Beyond Climate-smart Agriculture: Toward Safe Operating Spaces for Global Food Systems," *Agriculture and Food Security,* vol. 2, no. 12, August.

Olmstead, A, and Rhode, Paul (1993), "Induced Innovation in American Agriculture: A Reconsideration," *Journal of Political Economy,* vol. 101, no. 1, pp. 100–18.

Ramakumar, R. (2012), "Large-scale Investments in Agriculture in India," *IDS Bulletin*, no. 43, July 8, pp. 92–103.

Rao, N. Chandrasekhara, Pray, Carl E., and Herring, Ronald J. (2018), *Biotechnology for a Second Green Revolution in India*, Academic Foundation, New Delhi.

Rochon, Emily, Kuper, Jo, Bjureby, Erika, Johnston, Paul, Oakley, Robin, Santillo, David, Schulz, Nina, and Von Goerne, Gabriela (2008), "False Hope: Why Carbon Capture and Storage Won't Save the Climate," *International Nuclear Information System,* vol. 46, no. 5, Paris.

Ruttan, Vernon W., and Hayami, Yujiro (1973), "Technology Transfer and Agricultural Development," *Technology and Culture*, vol. 14, no. 2, February, pp. 119–51.

Smith, Pete, Martino, Daniel, Cai, Zucong, Gwary, Daniel, Janzen, Henry, Kumar, Pushpam, McCarl, Bruce, Ogle, Stephen, O'Mara, Frank, Rice, Charles, Scholes, Bob, Sirotenko, Oleg, Howden, Mark, McAllister, Tim, Pan, Genxing, Romanenkov, Vladimir, Schneider, Uwe, Towprayoon, Sirintornthep, Wattenbach, Martin, and Smith, Jo (2008), "Greenhouse Gas Mitigation in Agriculture," *Philosophical Transactions of the Royal Society B*: *Biological Sciences*, vol. 363, no.1492, pp. 789–813.

Swaminathan, Madhura, and Baksi, Sandipan (2017), *How Do Small Farmers Fare? Evidence from Village Studies in India*, Tulika Books, New Delhi.

Taylor, Marcus (2018), "Climate-smart Agriculture: What is it Good for?" *Journal of Peasant Studies*, vol. 45, no.1, pp. 89–107.

Venton, Daniel (2016), "Core Concept: Can Bioenergy with Carbon Capture and Storage Make an Impact?" *Proceedings of the National Academy of Sciences*, vol. 113, no. 47, November 22, pp. 13260–62.

Vermeulen, Sonja J., and Snorre, Frid-Nielsen (2017), "Measuring Progress Towards the WBCSD Statement of Ambition on Climate-Smart Agriculture: Improving Businesses' Ability to Trace, Measure and Monitor CSA," CCAFS Working Paper no. 199, CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS), Copenhagen.

Wildavsky, Aaron (1979), "No Risk Is the Highest Risk of All: A Leading Political Scientist Postulates that an Overcautious Attitude Toward New Technological Developments May Paralyse Scientific Endeavour and End Up Leaving Us Less Safe than We Were Before," *American Scientist*, vol. 67, no. 1, January, pp. 32–37.