

Assessing the Climatic Impacts of Farming Practices in the Tropics

A Literature Review

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Background:

Together with a broad network of partners, the Rainforest Alliance and the Sustainable Agriculture Network are developing a suite of climate change adaptation and mitigation criteria for the Sustainable Agriculture Network Standard – a leading standard against which farms are audited to achieve Rainforest Alliance certification. To inform the development of the criteria, corresponding verification methodology and guidance for farmers, a review of existing scientific literature was conducted. The 4C Association, CIAT (the International Center for Tropical Agriculture) and other agricultural/climate change research institutions and nonprofits and researchers all contributed to the review.

Goals

The literature review identifies climate-friendly agricultural practices that (a) lead to an increase of on-farm carbon stocks, (b) reduce emission of GHGs from depletion of on-farm carbon stocks and from the use of machinery and chemicals, and/or (c) improve the resilience of agro-ecosystems to adapt to a changing climate. In the review, these climate-friendly practices are established in accordance with local context and assessed against business-as-usual (BAU) practices.

The review also indicates the degree of impact and scale of gains to be achieved by transitioning from a BAU practice to a climate-friendly alternative, surveys of the state of research of GHG and carbon storage quantification (i.e. models measurement tools and/or methodologies) for selected practices, identifies barriers to farmer adoption of climate-friendly practices and points out gaps in existing research on the implications of certain tropical farming practices with respect to climate change.

Scope

The literature analyzed covers coffee, cocoa and tea farming in East and West Africa and Southeast Asia, with an explicit focus on Ghana, Indonesia, Kenya and Tanzania. Where research was lacking in the context of these countries or crops, information was incorporated from other regions – principally Latin America. The practices included in the review are as a sample of those commonly implemented in tropical farming systems which could generate significant climate impacts (positive or negative).¹ Practices assessed include land conversion, degraded land management/reclamation, fallowing and tillage, soil cover and soil fertility maintenance, weed and pest management, fertilizer application, processing activities and waste and water management among others.

Preliminary Findings

- In many instances the best opportunities for realizing climate benefits lie in discontinuing use of BAU practices that are the most significant sources of emissions. For example, halting forest clearing and doing away with slash-and-burn farming practices outright are strategies that in most agricultural

¹ The selection of practices analyzed in the literature review was informed by a prior review conducted by the Rainforest Alliance in the spring of 2010 that aimed to identify climate-friendly practices for Guatemalan coffee farms.

circumstances provide the largest reduction in direct emissions and the maintenance of the greatest possible carbon stock.

- Many climate-friendly farming practices relate to conservation of extant forestland and approximation of the forest structure in agricultural systems. Restoring degraded lands to the natural climax community and establishing complex agroforestry systems (i.e. multi-strata forests) for coffee and cocoa can enhance/preserve significant carbon stocks while also reducing emissions associated with common soil, pest and fertilizer management practices.
- It is inadvisable to prescribe a climate-friendly practice without first considering the local context; for example, shade management recommendations should be micro-site specific and account for slope, aspect, humidity and ground cover characteristics in order to optimize shade, production capacities and agrochemical inputs.
- The most common constraints to farmer adoption of a climate best practice are financial or labor barriers. For example, manual maintenance of coffee bushes to remove diseased leaves and on-farm production of organic pesticide/fungicides are both more climate-friendly than application of industrial products, however, their adoption may be infeasible, if not impossible, due to the level of effort they require of the farmer. Similarly, climate-friendly practices for water and waste management, energy conservation and processing activities often require the application of expensive new technologies (i.e. drip irrigation, alternative fuels or energy-efficient machinery). Even if costs can later be recuperated, farmers lack access to credit to pay for up-front costs.

Research Gaps

Over 300 research papers, scientific articles, and publications from reputable research institutions were reviewed by the study's contributors. As a result, clear knowledge gaps emerged. The review suggests that further research is needed on the climatic impacts of farm processing, waste management, and domestic and processing wastewater management. With respect to coffee, cocoa and tea and Ghana, Indonesia, Kenya and Tanzania, research on tillage, improved fallows, soil cover and erosion control appears to be lacking. In general, it seems that little climate change and greenhouse gas emissions research is available on coffee and cocoa in Africa and Asia relative to studies conducted on those crops in Latin America. To our knowledge very little research has been conducted on the relationship between tea and climate change outside of Asia.

In some areas of the Rainforest Alliance's research, such as pest management, existing studies were so context-specific that climate-friendly practices for pest control could be extrapolated to general conclusions. Further work to identify a middle ground between context-specific and general conclusions for pest management related to its climatic implications is recommended, though certainly it will be difficult to achieve.

Next Steps

An advanced internal draft of this review was developed to inform the standards development process for the climate criteria under the Sustainable Agriculture Network Standard, however, additional research areas can be enhanced. We are actively seeking the inputs and participation of technical experts and institutions to advance the review. For more information, please contact Jeff Hayward (jhayward@ra.org) or Mark Moroge (mmoroge@ra.org).

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