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Whose carbon capture? A bit of good news

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Abstract

Global policy, policymakers and government representatives in the OECD countries routinely ignore the potential role to be played by carbon sequestration from crop waste biochar made by poor smallholders in the developing world. This paper argues that this is a mistake and makes the case for the design, development, and distribution of low-cost, low-tech biochar making equipment to the world's poorest farmers living on small farms and possessing only widely and thinly spread biomass resources on rough terrain. It argues that paying attention to the crop wastes of poor farmers can reduce GHG and PM2.5 emissions considerably and contends that the private motivations that underpin this approach can replace the talk of large-scale social behaviour change with a self-replicating system built on farmers' envy.

Keywords

Biochar; climate change; developing world; low-tech; low-cost; solution

1. Introduction

"Whose carbon capture?" is not an idle question. The National Academies of Sciences, Engineering, and Medicine (USA) call for us to remove 10 gigatons per year of CO_2 equivalent annually until 2050. (National Academies of Sciences, Engineering, and Medicine (USA): accessed 10/12/2022) A recent internet ad for a direct air capture complex (the coolest and best funded stuff around) suggested that the facility (the largest in the world) would be able to remove 0.5 gigatons annually by that time. Not a big piece of the pie. "So, why worry? "We" all ask? "We" defined here as those developing low tech, distributed biochar systems and applying the EBC Artisan Farmer accreditation system. We think that we are making great strides; the question is, therefore, "Just who is working on this carbon capture, for whom, and to what end?"

2. What is the problem?

As normally understood in the biochar world (indeed, most places), "we" are those in the West, North, OECD, or whatever countries. Here is the problem. Today's world population is 8 billion, but "we" are less than 15 percent of it, and by 2050, "we" will be less than 12 percent. (Worldometers: accessed 10/7/2022) What of the "rest" who are currently 85.7 percent of the world's population and by 2050 will be 88.3 percent? Just what claim do "we" have on decarbonizing the atmosphere? What are "we" decarbonizing for, for whom, and how?

If we use UNFCCC agreements as the benchmark, then the 1997/2005 (passed/ratified) Kyoto Agreement marked the beginning of a degree of Western climate awareness and willingness to engage in climate change. Kyoto, however, used a carbon emissions trading system that regularly amounted to little more than accounting trickery and allowed (according to some, caused) global atmospheric carbon (yes, much from developed countries) to rise dramatically.

(Napoli, C.: accessed= 10/12/2022) The idea, however, was that since "we" made the problem, "we" should be responsible for fixing it. While "we" may indeed have once caused most of the problem, by 2005, this was clearly no longer the case, as demonstrated by China's and India's CO2e contributions to global emissions being ranked one and two on the great tally board. What to do? The 2015 Paris Accords tried to target carbon removal, and this made considerably more sense than the old Kyoto system. Unfortunately, it did nothing to solve the underlying political problem, i.e., that neither China nor India wanted to play, that Donald Trump would pull the USA out of Paris, and that the Saudis and Russians have no interest in reducing fossil fuel use. In other words, international diplomacy could not crack the "whose carbon capture?" problem, despite the big role in climate change gas (GHGs) emissions played, of GHG production by the rest and how (by whom) this is to be done. (The meltdown in Madrid over who would pay how much for what made this clear to the world.) (Hood, M.: accessed 10/12/2022) Sharm El'Sheikh did little to improve this picture.

3. What is to be done?

How will we get around the dreams and egos of China's, India's, Russia's, and America's rich and educated upper classes? How can we deal with the likely collective action failure of any large-scale behavioural change effort (e.g., everyone "ought" to go vegan)? Should we just give it up today?

4. We should not quit.

"We" should, instead, look to the "rest of the rest" to help with our planetary problem." And who are these folks? They are the billions of poor people who have never had any say in making climate change policy.

What is the alternative? Even if you discount the importance of GHG-belching hand-me-down diesel lorries and buses and the emissions of hand-me-down factory and power generation equipment in the "developing" world, another key problem source lies right where the poor live: in the carbon-containing waste left in their fields to rot or be burned. If open field are burned, after all, crop waste around the world generates gigatons of GHGs and PM2.5. If allowed to rot, it is equally dangerous to the atmosphere, although not to our lungs.

5. Squaring the circle

What can the illiterate, isolated smallholder farmers of the rural developing world do? They can make biochar from their crop wastes using small-scale, highly distributed biochar-making "machines"[i] (And, with all due respect to statisticians, Shafer's "law of big numbers" is that anything times one billion is big! There are 525 million poor farms out there (84 percent of total farms). (World Bank, accessed 10/12/2022) At a household size of a little less than 5, this means that there are 2.5 billion very poor people living on small holdings. (Samberg et al.: accessed 10/12/2022). If only 250 million farmers made a single tonne of biochar (approximately 20 percent), they could sequester 0.5 gigatons of CO2 right now for as little as $50-$75 per tonne, not the outrageous amounts now paid in the OECD countries to outfits such as Direct Air Capture, Inc..) (Personal communication: Carbon Futures, 8.25.2022)

Why not use the big, high-tech machines used in the OECD? In part because they are too capital-intensive for an almost worthless feedstock and product. (Here the problem is also that intense competition in OECD markets has elevated economies of scale in production to first place for business but also results in heavy regulation.) (Personal communication, Hans-Pieter Schmidt, Ithaka Institute, 8.25.2022) When considering much crop waste (cassava tops, cocoa pods, maize and millet stalks, rice straw, etc.), much is widely and thinly distributed across tough terrain and cannot be collected cost-effectively. Distributing bigger, high-capacity pyrolyzers to each poor farmer or even farming community makes no sense. Besides, bigger machines cost more money, quickly eliminating poor farmers from the game.

Faced with gigatons of crop waste burned every year (estimates range from 50 to 90 percent of total waste burned), generating gigatons of CO2e, CH4, PM2.5, and so on, that would never be collected or charred, the questions are: "Can small-scale, farm family sized pyrolizers work? Can they make enough char of acceptable quality?"[1]

[1] These questions are regularly asked at climate change and biocharist meetings.

6. Warm Heart's contribution

At Warm Heart, where the problem presented itself initially in the form of choking smoke for three months of the year. We answered both questions in the affirmative. We spent 2016 to 2018 developing low-cost, minimal-tech family-sized machines. In part, this meant reducing the cost and construction complexity of building long-standing machine designs (reducing the Jolly Roger TLUD (Top-Lit, Up-Draft) oven from three costly barrels to one, improving transportability, and limiting the materials and technical skills requirements). Elsewhere, it required cutting the cost of materials, lowering the weight, and eliminating the need for a skilled welder that such machines as the Kon-Tiki demanded.

Having tested these simplified machines with local farmers and demonstrated the quality and quantity of biochar they could produce, Warm Heart moved on to larger-scale (greater numbers of uninvolved farmers) tests. We randomly selected a high-corn waste producing district where we were unknown and introduced ourselves. We formed a Community Advisory Board (CAB) with veto power over our work. The first CAC immediately vetoed our plan, but with certain stipulations produced and agreed to a variation of it. We offered 2 baht (US$0.15) per 10-kilogram (kg) bag of char produced. The community made 15,000 bags before we had to call off the experiment because we had no more money.

In keeping with our mission, Warm Heart's initial idea was to create a self-sustaining (because profitable), self-replicating village social enterprise that produced both biochar and value-added biochar products, paying farmers for the former and villagers for the latter. This proved to be impossible for many reasons. The level of internal division within the village dampened the idea of a village coop, while the lack of business skills left the farmers unable to imagine setting funds aside to cover operating costs at the start of the next year. No one wanted there to be any money left over that might be stolen by one or more members of the coop. The real problems, however, had to do with production. The equipment was too costly, the area lacked 3-phase power and, most importantly, we could find no local market for the value-added products. Biochar-based fertilizer offered the highest margin, but was rejected by nearly everyone, largely because both the fertilizer and hybrid seed salesmen (who were the villagers' most important source of new agricultural practices) and the government did not support the ideal. (Actually, Bangkok talked a lot about biochar at meetings, but discombobulated as the government is, it could not communicate this to the provinces where the local "maw diin," literally "dirt doctors," hold sway.)

It took a while, but we eventually recognized that no one in the community felt that smoke mattered. It was simply there. (Why should little old me try to do anything? This is "*their*" problem, whoever "*they*" are. Let *them* stop the smoke.) Likewise, potential buyers of smokeless biochar briquettes cared only about price and ignored what we at Warm Heart thought would be the key selling point: the fact that they did not smoke or cause health problems. Our primary customers, large international hotel and resort chains, closed with the pandemic. We soon discovered that there was an excellent international market for biochar and biochar-based value-added products, but that in the international market, nothing mattered more than the certification of the biochar itself.

7. Certification

We immediately began investigating certification, but soon found that none of the existing international certificates applied to small farmers. Instead, these systems (IBI, EBC, Verra, and Gold Star) were all intended for use only in the OECD. Although they were applied to all biochar inappropriately, unintentionally, and misleadingly, they were impossibly complex and costly for Warm Heart and for the hundreds of millions of farmers we hoped to represent. Beginning in 2020, therefore, the Warm Heart Foundation (which I lead) devoted itself to this problem. Warm Heart approached, in particular, the International Biochar Initiative (IBI) and the European Biochar Consortium (EBC) to argue that it made no sense to exclude the poor (who could benefit financially and agronomically from certification) when crop waste burning constituted such a large source of GHGs, PM2.5, rapidly rising healthcare costs, and total agricultural resources.

Luckily for me, key players in the international biochar world, notably Tom Miles, President of the IBI, Kathleen Draper; Director of Science at IBI and Hans-Pieter Schmidt, Founder of the Ithaka Institute and the most important voice inside EBC, also believed that the poor should be included. After two years of pushing, cajoling, and providing

solutions (e.g., the use of blockchain technology and a cell phone-enabled app), the EBC finally published its "Tropical Farmer Standards" (now the "Artisanal Farmer Standards.")

On March 4, 2022, just six and a half months before the preparation of this article, the EBC and Warm Heart joined in an IBI-hosted webinar to announce that Warm Heart was the first organization in the world to be recognized as accredited to certify small farmers' biochar as sequestering CO2 and so deserving payment for Carbon Removal Credits.[2] We were immediately buried in requests from poor farmer organizations globally and were forced to stop accepting new applicants when our backlog reached 55. They remain on hold while we try to deal with really big organizations such as CORUS, with millions of farmers in their systems.

The keys to all verification efforts for high-tech or low-tech biochar require proof that (1) the quantity and (2) quality of the biochar are as stated and that (3) production is not polluting. EBC's own data indicated that the char quality is high and the amount of carbon (C) in biochar made from each different feedstock is X or Y. Warm Heart developed a system for "weighing" biochar in the field, the cell-phone app (to verify appropriate production standards through GPS and date-encoded photos and videos), and the case for using a blockchain (to ensure that records could not be changed).

Despite the development of such a system, as a small NGO, Warm Heart faced a major problem: how to verify what, exactly, the ever-growing number of farmers is doing? To deal with the problem, Warm Heart established Biochar.Life, PBC,[3] to carry out large-scale production verification as well as sell carbon removal credits and pay individual farmers for the biochar they had certified. Since March 4, 2022, Biochar.Life has paid poor farmers in Kenya and Malawi $56,000, $175 per participating farmer. Owned by Warm Heart, we also hope that Biochar.Life will support us and our programs over the long term. If so, Warm Heart will become the only entirely independent NGO in Thailand; that is, without international, religious, or Royal patronage.)

The great thing about the Warm Heart/Biochar.Life system is that it is entirely market based and requires no costly, foreign interventions to replicate. The first step of its operation provides participating farmers with a financial incentive to convert waste biomass to biochar. The second step, available after participation, involves the farmers' soil improvement, better water retention, and higher yields from the use of biochar in their fields. With this system, we did not have to convince anyone of anything. Those (generally, the poorest of the poor, single women heads of households) participating make money immediately and see continuing rising returns with use. Sooner rather than later, those who chose not to participate at the start, look at participants' greater incomes and ask to join as well. The individuals in both groups make private decisions to participate based on their own calculation of what is best for them. Given existing disparities, the program may actually increase local inequality, but it raises the floor for the poorest.

8. Conclusion

It is surely inadvisable to ignore the very poor, who constitute a huge portion of the world's population, or to consider only high-volume, high-tech, centralized equipment when seeking to reduce global GHG and PM2.5 emissions. To sequester CO2 and improve the quality of life of the poor, it is essential to stop the open-field burning of crop waste. Rather than posing this as something that "ought" to be done (By whom? Says who?), Warm Heart's system involves abandoning efforts to affect large-scale social change. (This is simply a reality check. If all change depends on costly outside help, there is not enough money to help all these farmers. As a result, big efforts often create a "Swiss cheese" effect with lots of "holes" in development and little in between.) As it costs very little, is profitable, and grows on its own, the Warm Heart system provides the model for a self-replicating, self-sustaining system in which the incentives are private (the acquisition of money and improved agricultural performance) and not simply changed relative prices

[2] Since we were accredited, similar systems have been published, notably by the Verra Institute.

as a result of inflows of outside money or the exhortations of NGO staff about climate change and the health consequences of breathing a lot of smoke.

What is required? The literature is very thin, and considerable research is needed. Specifically, it is necessary to study the actual sequestration of CO2 by biochar and that sequestration's durability. Likewise, little is known about the value of biochar-based fertilizers in different soils and under different conditions. These suggestions, especially the second, pose uncommon research demands on scientists since this work cannot be conducted in the laboratory. Such lab results will then need to be fitted into an economist's model to understand their implications for smallholder farmers.

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