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Commentary Article

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The Future of Biochar Is Not European – It's Global, Distributed, and Southern

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ABSTRACT

The issue is not artisanal, distributed biochar today. It's the future. And the future, inescapably, is about the numbers.

There is no denying the central role Europe currently plays in the global biochar story. Europe purchases the most biochar and has developed the world's most robust carbon credit markets. It is also the only region that has integrated biochar and negative emissions technologies into coherent climate policies. In sheer market terms, Europe rules. Its centralized, large-scale, corporate-driven production model also dominates. And for now, that dominance has left artisanal or distributed production especially the kind practiced by smallholders in the Global South on the margins.

But the future is not decided by today's market dominance. The future is decided by scale, feedstock availability, and the basic math of climate mitigation. And on all those fronts, Europe's current dominance is fragile. It risks irrelevance if it continues to write off artisanal biochar and the distributed production models that make use of the world's largest untapped carbon sink: the agricultural waste streams of the Global South.

Keywords: Biochar, Artisanal Biochar, European Concerns, Distributed Biochar, Regulation

Why Europe Distrusts Artisanal Biochar

The European bias against artisanal biochar is rooted in regulation. European policymakers have designed frameworks to protect the buyers of carbon credits, with the guiding assumption that buyers must be shielded from fraud. The concern is straightforward: if hundreds of thousands of small-scale producers enter the market, how can regulators be sure that the carbon removal being sold is real, measurable, and permanent?

Regulators look at distributed production in the Global South and see chaos: countless producers, operating in rural and often remote contexts, using varied, often rudimentary, technologies, making oversight appear impossible. Their fear is not wholly unfounded. In a poorly regulated marketplace, biochar claims could indeed be exaggerated or falsified. Fraud would not only undermine confidence in carbon credits but could discredit biochar itself as a viable climate solution.

Thus, Europe has tilted toward the "safe" route: large, centralized production under corporate management and at home with clear accountability lines and streamlined oversight. The implicit assumption is that artisanal production, especially from the Global South, is inherently untrustworthy. The science is often ignored (for example, Cornelison's 2023 study showed that with dry feedstock even the most rudimentary technology produced virtually no greenhouse gas emissions.), and the Global South is too often treated as a regulatory black box, where smallholders are assumed to operate in lawless zones.

This view is simplistic. In many southern contexts, artisanal production is in fact subject to strict environmental, agricultural, or forestry regulations. But nuance rarely survives in international regulatory debates.

Why European Concerns Don't Ultimately Matter

Now let's turn from perception to numbers. Because the future is not determined by bias and cost. but by scale. Europe, for all its innovation and current technological leadership, represents

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a shrinking share of the global population. Once nearly 20%, Europe's share is projected to fall to just 17% in the coming decades. Meanwhile, in the Global South, 2.5 billion smallholders work most than 500 million small farms. These farms produce 30% of the world's food and as much as 80% of the food consumed in their own countries. Food production, in turn, generates staggering quantities of agricultural waste: billions of tons annually. Here is the crucial point: smallholders in the Global South are responsible for an estimated 80% of the world's agricultural residues (much of which is currently open field burned generating hundreds of millions of tons of greenhouse gases and millions of tons of deadly PM2.5. annually.) These billions of tons are far more than Europe can hope to harness effectively. If only a modest portion of this biomass were converted into biochar, it would surpass the IPCC's target of removing 10 gigatons of CO_2 annually to achieve global carbon neutrality. The feedstock potential is immense.

But it comes with a catch. Agricultural residues from small farms are thinly distributed across vast landscapes. Collecting them for centralized processing is economically prohibitive. Trucks, fuel, logistics, and storage erase the carbon and financial benefits. (This applies in spades to such technologies as Direct Air Capture (DAC).) The only viable model is distributed production—biochar made where the biomass is, by the smallholders who produce it.

This reality makes Europe's centralized bias not just shortsighted, but untenable. Without distributed production, the bonanza of southern biomass is unreachable.

The Argument for Distributed Production is Not Only About Arithmetic; It is also about Justice

Smallholders in the Global South live at the frontline of climate change. They are also those most vulnerable to droughts, floods, and soil "degradation", and they are consistently among the world's poorest people. Biochar offers them more than a climate tool: it offers a pathway to soil restoration, increased yields, improved water retention, and enhanced food security.

By excluding artisanal production from carbon markets, European regulation denies smallholders both economic opportunity and climate resilience. Carbon finance, if equitably distributed, could transform rural economies while simultaneously delivering gigaton-scale target carbon removal. Instead, the current system concentrates profits in large corporations far removed from the realities of smallholder agriculture. This applies in spades to such large-scale technologies as Direct Air Capture (DAC).

Equity demands that smallholders not only be included but empowered. Distributed production is not charity; it is efficiency married to justice. It aligns the interests of climate mitigation with those of rural livelihoods.

The Shift is Inevitable

Europe's corporate-centered model may dominate headlines and markets for now. But the underlying numbers point in a different direction. The Global South holds most agricultural residues, which centralized production cannot reach but distributed production can.

As climate urgency deepens, carbon markets will be forced to expand and seems to favor such technologies as DAC. Meeting the IPCC's 10-gigaton target however may be impossible in the future without tapping into the residues smallholders produce. Tapping into these residues is impossible without trusting distributed production.

Technology is also rapidly lowering the barriers to oversight. Remote sensing, blockchain-based monitoring dMRV, and mobile-based reporting systems are already making it possible to verify production even in rural contexts. What once seemed unmanageable is increasingly feasible. Regulatory frameworks will necessarily adapt. They must, or they will be by necessity.

A Call for a New Global Framework

Europe deserves credit for pioneering biochar markets and establishing rigorous standards. A system that treats the Global South as a regulatory black hole is not sustainable, scientifically or ethically.

What is needed is a new global framework that:

- Recognizes the legitimacy of distributed production.
- Builds verification systems tailored for smallholder contexts but also consider buyer protections.
- Channels carbon finance toward the people producing the most feedstock and facing the harshest climate risks.

Such a framework will not weaken carbon markets; it should strengthen them by expanding supply, lowering costs, and ensuring global participation.

Conclusion: The Future Is Artisanal and Distributed

Biochar today is at a crossroads. Europe's centralized, corporate model made a solid foundation. But the future by numbers alone belongs to distributed or artisanal production in the Global South. Either carbon markets adapt to include this biochar, or they consign themselves to irrelevance, bypassed by climate reality.

Smallholders are not the problem. They are tomorrow's solution. Europe may write the rules today, but in the future rules will be written by numbers, and the numbers point south.