

WorldStove's Critical Review of Biofuelwatch's "Biochar: A Critical Review of Science and Policy"

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BioFuelWatch, on their web page, states that they are "...a volunteer-led campaign group supported by grant funding and donations." Their declared aim is to "Campaign against industrial bioenergy, i.e. energy linked to industrial agriculture and industrial forestry". They state that their motivation is that "Industrial agriculture, industrial logging and industrial tree plantations are major causes of greenhouse gas emissions and of the destruction of natural ecosystems and biodiversity, which are essential for regulating the climate. They also drive the destruction of sustainable agriculture, displacing small farmers, indigenous peoples, forest and other communities. They are inherently unsustainable and can never be part of the solution to climate change." We see these as noble goals and motivations but remain perplexed by the fact that, **now for the third year in a row**, BFW insists in including our organization in their criticisms of biochar. We understand that there are those who would use biochar incorrectly but do not understand why, when criticizing those individuals, BFW consistently includes WorldStove despite the fact that our well published work is entirely in keeping with BFW's stated goals. Could it be that BFW's stated motivations are not their only objectives?

In a recent articles, (see Notes 1 and 1A below) BioFuelWatch, the African Biodiversity Network, and the Gaia Foundation state that, large-scale agrofuels have "led to large scale displacement of small farmers and indigenous peoples, displacement of food production, loss of food sovereignty, increased deforestation and ecosystem destruction and more climate change."

We at WorldStove fully agree that such effects must be avoided for a variety of ecological and moral reasons. In fact, our pyrolytic stoves and our Five Step Program (www.WorldStove.com) have both been designed to that end. Both were designed specifically to empower small farmers, increase food sovereignty, and decrease deforestation, thereby preserving ecosystems and mitigating climate change. We point out that the last three phenomena are all interrelated and are contributing to the severe loss of biodiversity that is now well documented through the world.

This letter is a response to those and related references.

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First, we are pleased that BFW acknowledges that biochar and agrofuels are not synonymous. BFW “Biochar and agrofuels are not the same.” (Note 2) The real worry is massive land grabbing for agrofuels, not biochar *per se*.

Our second point is that, for the past three years, BFW has consistently attacked pyrolytic stoves, and we continue to defend them here: Since people have to cook their food and, when possible, boil water for drinking. (We will say more on stove number and impact later) We ask which stoves would BFW encourage people to use?

Rocket stoves require wood. Alcohol stoves consume distilled products of grain, sugar cane, and corn (*Zea mays*); charcoal stoves burn 7-12 kilos of wood for every kilo of charcoal burned. All of these contribute significantly to deforestation and loss of biodiversity. Solar cookers and retained heat cookers, are both quite efficient but have very limited applications. Although some promote LPG stoves for cleaner air and less deforestation, for people living on less than \$2 a day, this is, at best, an insult. We maintain that small pyrolytic stoves do the least environmental damage since they can function with small waste biomass which presently is usually disposed of by burning or decay. **In fact, by converting about 20% of the waste biomass to biochar, these stoves are actually carbon negative. Pyrolysis of waste biomass is thus ecological, affordable, and one of the few mechanisms for actually reducing atmospheric CO₂.**

Our third point is that, although BioFuelWatch (BFW) and the Gaia Foundation (GF) consistently malign our stoves and programs, we will continue to move ahead with our work and, once again, point out errors in their statements.

For example, **BFW maintains that there are no large quantities of waste biomass available for conversion to biochar when they call into question the claim, “... That there are vast quantities of —wastes and residues available from agriculture and forestry.”** (Note 3).

Clearly BFW has forgotten that on 7 July 2010, (Note 4) , we pointed out to them that, in Egypt, 20 million tons rice straw per year are burned for disposal (Esawy, et al. 2009), landscape debris in the USA is 32 million tons a year, (Marinelli, 2008), another 345 million over dry tons of forest litter are available from accessible areas (Rummer et al. 2003), and Strand and Benford (2009) calculate that global annual crop residue production, is 4.98 Pg/y as dry weight.

Continuing with the same question, Gaia Foundation states that **“The biochar advocates speak of ‘residues’ without clarifying where these would come from.”** (Note 5). But, we had previously informed them that, according to Strand and Benford (2009), “Globally, just 30% of crop waste from five major food crops would provide 600 million tons of residue safely available for charring without reducing soil fertility or increasing danger of erosion.” More recently, referring to (Woolf, et al. 2010), they again question the

implication that large quantities of residues available for pyrolysis. (See Note 1 and cited in their “*Critical Reviews*” paper and Note 6).

Obviously, our earlier reply year was not sufficiently convincing, so we now offer additional data on this point: The Federal District of Mexico, daily, collects about 1.4 kg of waste (40% organic) for each of its 8.87 million inhabitants, a total of 1,812,995 tons organic per year. (See also Brian et al., 2009) Furthermore, food waste alone, in the US, is the energetic equivalent of annual extraction from oil and gas reserves off the nation’s coastlines (Cuellar and Webber, 2010). Furthermore, about “37 million Mg [Mg (megagram = dry ton)] (41 million dry tons) of residues... produced during the harvesting of forest products, fuel-wood extracted from forestlands, ... and forest resources that could become available through initiatives to reduce fire hazards and improve forest health.” (Steiner, 2010)

Finally, "According to a U.S. Department of Energy study, (DOE/EE/15425-H 1), solar and biofuels account for 87.8% of the economically accessible fuel of the future. Not only does biomass represent a massive resource base, but this resource base can be accessed now, not like many of our other alternative energy options that may have impacts 20 years or more in the future. Biomass processing with a balance of energy and char products, is the ONLY method of producing energy that is potentially CARBON NEGATIVE (Dobson, 1993), (Note 7). Data of this sort are well documented and available for much of the world.

As a matter of fact, in BFW's own country, there exists so much waste biomass that Biffa has opened a power plant in *near Cannock, Staffordshire* that utilizes only a small part of the 15 million tonnes of food waste generated each year by the UK to provide the energy needed by 6000 homes (<http://www.recyclingportal.eu/artikel/26838.shtml>). With all this information available is it the case that BFW is only terribly misinformed or do they have reasons for deliberately distracting others from the realities of effective solutions?

BFW also asks “Some, such as “Worldstove” promote use of 'micro-gasifier' cookstoves which retain biochar, as an option to traditional open fire cooking. Although such stoves will be more fuel efficient than open fires and some improved biomass stoves, they are less fuel efficient than micro-gasifier stoves which do not retain char but burn it to ash.” (Note 3).

During pyrolysis, the system operating in WorldStove products, 70% of the energy in biomass is released in low carbon volatile gases (Sohi et al, 2009). This technology is designed to utilize 93% of this 70% (that is, 65% of the total energy available). Compared to open fires’ 7%-12% efficient or improved stoves’ 40%, including some other micro-gasifiers, all of which burn some or all of wood to ash, 65% is a real improvement. Burning solid residues to ash may extract more energy (20% of the total originally available). However, just as a modern kitchen gas stove must be adjusted to burn methane versus propane, burning biochar in a stove designed to burn flammable gas, will be of low combustion efficiency. Smoke, black carbon, and other unburned hydrocarbons will be released onto the surrounding (and global) air.

This idea of burning to ash misses the point that the remaining biochar is a valuable byproduct in itself. It serves to filter the emissions from the stove, reducing still further the emission of small black carbon particles, and, in many of our programs, the biochar has been successfully used to filter water or to create toilets. Our efforts to this end and contribution in this field have been recognized by the SUSANA Foundation. (Note 8).

As for the 20% of energy left in biochar, the biochar from a single meal cooked with a LuciaStove is sufficient to filter up to 100 liters of chlorine treated water. The amount of energy saved by not having to boil 100 liters far exceeds the 20% left in biochar.

BFW maintains that pellets are sometimes hard or impossible to find, overlooking that pellet production is an essential part of our Five Step program. We have successfully established local pellet production in small villages in many of the countries in which we are working. This has created the availability of low cost or free pellets and also permanent, self-sustaining local jobs in areas that were economically disadvantaged.

BFW states that small pyrolyzing cookstoves cannot produce enough biochar to improve soil fertility (Note 1).

They state, "In some, though not all, cases, crop yields improved when such biochar was applied at a rate of 20 tonnes per hectare. Producing this amount of biochar, not for a pot but for a one hectare field, would require a family to save up biochar from a stove over many decades (by which time, of course, it would not longer be fresh biochar and might not have the same impacts on crops). WorldStove for example, reports that a family cooking on one of their stoves three times daily for a year would produce about 438 kg of biochar over the course of the year. Therefore it would take about 46 years to produce enough biochar to treat a hectare of land with 20 tonnes of biochar."

This is a gross misrepresentation of the facts that we generously provided for them nearly two years ago, 13 Dec 2009 (Note 9). In that letter, we explained that, "The most common mistake with viewing the 8-30 tonnes per hectare as a requirement for crop increases, is neglecting the fact that these figures refer to concentrations of char. Since plants are spaced, the common agricultural practices of side dressing or top dressing, as is done with other soil enrichment practices, allows even small amounts of char to achieve even the high concentrations that you correctly acknowledge as being beneficial to both plants and soil." If this sound agricultural practice is applied in arid regions, the char from a single pyrolytic stove can be used to plant as many as 6,083 corn plants per year. (Glaser, et al. 2002) That reference clearly explains that soil water retention increased by 18% upon addition of 45% volume of charcoal to a sandy soil). Other benefits for biochar in soils are documented elsewhere. See also Note 10.

Thus, we emphasize that current CO₂ concentrations of 387 ppm are considered higher than the Earth can sustain with a human population of nearly 7 billion people. We at WorldStove are working to bring improved health and safety to people **while also reducing atmospheric CO₂ through biochar production**. With these very real problems that we have been working to alleviate for nearly a decade, we find it perplexing that BFW continually misstates facts, ignores published scientific works and associates us with those who would misuse or incorrectly apply biochar.

After three years of attacks of this nature we can not help but ask about BFW's hidden drivers.

Finally, we wish to explain how, by improving the lives of people living on less than \$2 a day and reducing the ecological impacts of deforestation, small stoves can have a large impact in the world.

For example, in a widely cited publication, Pacala and Sokolow (2004) proposed 15 possibilities for limiting CO₂ emissions using today's available and proven technologies. Each possibility is termed a "wedge," and, if vigorously implemented for the next 50 years, each would be capable of reducing CO₂ emissions by 1 GytC/y. Any seven of such wedges, together, would cap atmospheric CO₂ to 500 ± 50 ppm within the next 50 years. The above paper is critically important in demonstrating that stopping climate change is possible.

Since 2004, additional wedges have been proposed (Bahor, et al. 2009; Nolon, 2009, Larson, 2010), plus our own, described below. Steiner also (2010) has provided data on the availability of forest waste, without using the term "wedge". We note that several of these new proposals, like ours, utilize waste biomass, now recognized as an abundant, readily available, and sustainable resource.

Our own proposal employs pyrolysis to consume waste biomass for fuel, production of biochar, and reduced need for firewood. **Ours is unique in that it is the only wedge capable of actually reducing CO₂ currently in the atmosphere, rather than just limiting emissions.** (Note, reducing atmospheric CO₂ by sequestering it in carbonized agricultural waste was originally proposed by James Lovelock (see Vince, 2009)).

For those who doubt that small stoves can make such a difference, we note that people in developing nations use between 0.36 and 1.4 metric tons of wood per capita, per year, for cooking and heating (Arnold, 1978). If we consider only the low figure of 0.36 mt per capita, which equates to emissions of 1,650,150,000 mt CO₂ per year, the equivalent of 1.65 Pacala wedges from all traditional cooking stoves and open cook fires. Changing open burning to pyrolysis stoves would save that carbon already sequestered in trees. Using waste biomass for fuel would sequester another 267,530,000 mt CO₂ per year. Combining these two values gives the total sequestered saved by not harvesting trees & as biochar from waste biomass equates to 1,917,680,000 mt CO₂ per year, almost two Pacala wedges. (One of the proposed Pacala wedge is to replace coal power plants with 700 GW of nuclear reactor

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capacity, twice the current nuclear capacity, see Pacala and Sokolow, 2004). In terms of carbon emission reduction, two such wedges would be the equivalent of adding four times the current nuclear power capacity to replace coal burning power plants worldwide. Skeptics will say changing open burning to pyrolyzing stoves will be difficult, and we certainly grant that it is. However, we ask the skeptics if they believe that constructing and placing new nuclear power plants, with nearly four times the current nuclear capacity, in various backyards, will be easier.

In conclusion we are willing to acknowledge that it is quite possible that BioFuelWatch's intentions are good, and they are working hard to prevent land-grabbing and avoid the exploitation of land and people. If, however, this is the case, we strongly advise that they review facts and scientific documents more carefully so that in their effort to do good they avoid hindering working solutions which are currently achieving their stated goals.

We appreciate that this is the third anniversary of imprecise criticism of WorldStove by BiofuelWatch. In a sense we are grateful to BioFuelWatch for, in that they only criticize our stoves, they are acknowledging the impact our Five Step Program has been having throughout the world. As flattering as their consistent recognition of our efforts is, it is worth scrutinizing their true hidden drivers. Is it perhaps because we are the first biochar stove to receive certification as a means for sequestering CO₂?

After all, applying the logic of BFW's criticism of our efforts to other fields would be to say that because people have committed vehicular homicide, ambulances should be outlawed. Clearly this approach to any argument cannot work. After three years of BFW's categorical refusal of the good that biochar is currently doing we are left asking, "Why does BioFuelWatch refute fact and science, which we continue to cite, even when biochar based projects are already making the environment and the lives of people throughout the world better. Is it because they would rather not admit they were mistaken about biochar, even when it is permitting many to achieve BFW's claimed objectives, or is it for some reason far more unsettling?"

NOTES

Note 1. <http://www.biofuelwatch.org.uk/docs/Biochar-%20A%20Critical%20Review%20of%20Science%20and%20Policy%20June2011.pdf>

Note 1A.

[http://www.gaiafoundation.org/sites/default/files/Biochar%20Africa%20briefing\(2010\).pdf](http://www.gaiafoundation.org/sites/default/files/Biochar%20Africa%20briefing(2010).pdf)

Note 2. http://www.biofuelwatch.org.uk/docs/agrofuels_and_biochar_article.pdf

Note 3.

[http://www.biofuelwatch.org.uk/docs/critical_review_of_biochar_science_and_policy_\(Executive_Summary\).pdf](http://www.biofuelwatch.org.uk/docs/critical_review_of_biochar_science_and_policy_(Executive_Summary).pdf)

Note 4.

http://worldstove.com/wp-content/uploads/download/reply_smolker.pdf

Note 5. [http://www.gaiafoundation.org/sites/default/files/Biochar%20Africa%20briefing\(2010\).pdf](http://www.gaiafoundation.org/sites/default/files/Biochar%20Africa%20briefing(2010).pdf)

Note 6. http://www.biofuelwatch.org.uk/docs/agrofuels_and_biochar_article.pdf

Note 7. <http://freedombiomass.com/News/CSA-Is-Key-to-US-Energy-Future>

Note 8. <http://www.susana.org/lang-en/partners>

Note 9.

For that statement, see the following:

http://worldstove.com/wp-content/uploads/download/a_reply.pdf this is our reply Dec 13, 2009

Note 10.

Dec 19, 2009 we explained to BFW in the following:

-- <http://alexengwete.blogspot.com/2009/12/cop15-5th-global-day-of-action-on.html>

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