



Biochar Sweeps East Africa

by Dr. D. Michael Shafer

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One small farmer at a time



Daniel from Kisumu, Kenya waves from his biochar charged vegetable patch.

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Sr. Miriam Paulette's Mission

Sr. Miriam Paulette represents the Warm Heart Biochar Project in East, Central and Southern Africa. You will also find us in Paga, Bolgatanga, Northeast Region, Ghana, where we are Rural Renaissance-Warm Heart and represented by Abeidi Bawa.

Introduction

When most people think of East Africa, they visualize great roaming herds of wildebeests and mighty lions; most of those who live in East Africa see wide, treeless vistas of straggly corn, degraded, red soil, and huddles of mud huts.

Rains are increasingly unpredictable and storms more terrible. Temperatures are rising, crop pests multiplying and old diseases spreading again.

Every year, fires rage across the countryside, the smoke reddening the sun and killing thousands of the young and elderly.

Africa is the current darling of the international aid community. Public and private organizations devote huge amounts of money, effort and technology to improving the quality of life of the average small farmer in Burundi, Kenya, Tanzania, Uganda, Malawi, Zambia and Zimbabwe.

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East Africa, for example, has become the global testbed for advances in smart phone healthcare expert systems and financial applications.

The Government of Malawi has defied world economists' expectations by showing the efficacy of subsidized fertilizer.

The very poor at the rural fringe of development, however, remain largely unhelped (and still cannot afford subsidized fertilizer in Malawi).

The problem is simply one of scale. As long as development depends on big interventions, there will be neither enough money nor enough time to get to all of the truly marginal any time soon.

Is there no other way?

Sister Miriam Paulette thinks so. Sr. Paulette, Carmelite nun at monastery in Zomba, Malawi, is Warm Heart's Program Director in East and Central Africa. An old proverb inspires Sr. Mary: A candle loses nothing by lighting another candle.

According to Sr. Paulette, the same applies to helping others. Passing on knowledge costs nothing, so Sr. Paulette asks everyone she teaches for just one thing: the promise that they will teach one other person.

What does Sr. Paulette teach?

Blind faith?

Hope for a miracle?

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No, Sr. Paulette teaches about biochar,¹ a simple, sustainable solution to poor soil discovered by the peoples of Amazonia 4,000 years ago and still effective today.

In fact, the basics of biochar that Sr. Paulette teaches provide an immediate, effective, homemade solution to many of the problems that confront the poorest farmers of East Africa. Sr. Paulette's biochar making program:

Sharply reduces the CO2 emitted when farmers light those huge fires to clear fields; and

Sharply reduces the black carbon, smog precursors and PM2.5 those fires otherwise emit.

Using biochar as Sr. Paulette teaches them, poor farmers can:

Restore damaged soils

- Improve yields
- Increase water penetration and retention
- Reduce acidity
- Revitalize soil life
- Bind up contaminants that would otherwise enter the water and food chain

Make their crops healthier!

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She also counsels farmers that biochar in animal feed, bedding and manure slurries will

Improve animal health

- Improve animal health
- Reduce smells and fly counts
- Increase weight gain and laying
- Produce a powerful, natural fertilizer.

Is Sr. Paulette's approach complex and costly?

No.

The technology is so simple that "technology" is too fancy a word for it. At the high end, her equipment requires a 200 litre drum and the tools to cut it.

A 200-litre drum is precious in East Africa, however, and out of reach for many small farmers. Sr. Paulette, therefore, also teaches how to make biochar by digging a hole in the ground. That much, any farmer can do.

And, frankly, how complex can a process be if it requires no more than a hole in the ground?

The real questions, however, are these: Does it work? Will farmers do it? Will farmers teach other farmers? Does the biochar they produce perform as promised?

Yes.

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Sr. Paulette started by teaching herself to make biochar. She then taught poor farmers who attended church at her convent.

Together, they experimented with making biochar, applying biochar in agriculture and feeding biochar to animals.

Others observed the amazing results that they were achieving and asked to learn. Sr. Paulette's biochar project grew.

Today, you will find corn, millet, and vegetable farmers, chicken, cow, pig, quail and rabbit farmers in Burundi, Kenya, Malawi, Uganda and Zimbabwe making and using biochar following Sr. Paulette's teachings.

This is the story of how Sr. Paulette got started, how and where her approach to making and using biochar are being applied and how she ensures that candles keep lighting candles.

Michael Shafer

Director, Warm Heart Foundation

A, Phrao Chiang Mai Thailand

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Editor's note: What follows is Sr. Paulette's report. I have made occasional word changes and grammatical fixes. Where I went beyond this, I have marked the text "Editor's Gloss".

The two sections that I felt needed to be rewritten for clarity are "Making Biochar" and "Biochar Making Machines". I have taken complete responsibility for them, even switching the voice to refer to "Sr. Paulette".

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OUR MISSION



Improve quality of life for poor people

Improve sustainability in face of climate change

Sister Miriam Paulette

Carmelite Monastery, Zomba, Malawi

How we reach to the people

Our secret towards the success of reaching out to many with biochar is that whenever we introduce one person to the use of biochar we insist that they share the knowledge gained with a friend.

Why?

Because the knowledge about biochar is just too good to be kept by one individual. It would be selfish on one's part not to tell others about this new marvelous technology.

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The sharing of the knowledge must become like a chain. Knowledge shared is not wasted.

What we wish to accomplish

Biochar can do a lot of things for Malawi as a nation and the whole of East Africa. Our mission objective is to provide people with cheap but effective means of sustaining their lives.

To achieve our mission have embarked on a journey to reach out to as many people as we can and teach them how to make and use biochar. Here is what we want to do. We want to improve the quality of life of very poor farmers. To do this, we want to improve farmer's:

Soil

Biochar restores soil damaged by over-use of chemicals. Biochar also improves bad soil. It improves soil structure, reduces acidity and increases water penetration and retention.

Crop Yields

Biochar alone (or better with organic matter like manure) dramatically increases harvests

Animals' nutrition

Add 1-3% biochar to animal feed improves weight gain and egg laying. Mixed with molasses, iodized salt and crushed eggshells, it provides a good, cheap dry season cattle feed additive.

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Animals' health

Biochar in chicken, cow, pig or rabbit food reduces intestinal illnesses.

Health and their families', too

Making biochar stops the smoke given off by field fires. Reducing smoke/PM2.5 levels also reduces lost productivity and death from smoke related sicknesses. The World Health Organization ranks PM2.5 as the fifth biggest killer in the world. Poor farmers breathe PM2.5 every day they burn and every day they cook with firewood.

Income

Biochar can raise poor farmers' incomes by improving their crops and by giving them something new to sell in the market.

What we must accomplish

Bringing biochar to the poor farmers of East Africa should not be a costly project. It will take time, but one candle can light many candles and each of those candles can light many more candles.

Bringing biochar to poor farmers should not require money – because making and using biochar does not require money. Bringing biochar to poor farmers is about spreading the word. It is about teaching.

What we need to do to speed up the transmission of the message about biochar?

We require ways to communicate to more people more effectively.

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We require:

Teaching and training

Mobile teams of poor, local farmers who can speak the local language and can explain biochar directly and effectively.

Radio advertising

Radio ads. Everyone listens to the radio. The easiest, most cost-effective way to reach lots of people is by radio. We need ads spoken by local farmers in their own languages, placed just before or after popular programs.

Strong, visual posters

Posters. We need graphic poster that make their message without depending on language to distribute to schools, government offices and churches.

Inexpensive t-shirts

Cheap t-shirts with biochar messages. Everyone likes t-shirts and they keep on repeating our message. We should hand them out at village trainings.

How can we do these things?

It is necessary to be imaginative and creative. If you wait for someone else to help, you will wait a long, long time. Just think how long we have been poor and waiting!

So, what can we do? Here are a few of my ideas. *You should come up with your own, too.*

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Teaching and Training

- Creating training materials: Many of us in many countries already know how to make and use biochar. What we are lacking are simple, recorded methods for (1) training farmers and (2) training farmers to train other farmers. We all know university students, teachers and farmers. Why not bring a few together to spend a day preparing a training package?
- Getting out to do trainings: We know NGOs that have trucks. Why not ask them? We belong to churches. Why not ask for bus fare? We know people who live in other places. Why not ask them to take materials with them when they go home?

Radio Advertising

- Making the ads: Have you ever made a radio ad? I haven't. But I am sure that there are people who do know. Why not ask? Maybe they will donate their time. If not, ask others to donate money. It cannot cost very much.
- Getting the ads on air: Call the radio station. Would they donate airtime? Would they donate ad time they do not have paying ads for? Would they give biochar a discount price? What about asking the big companies that advertise on the radio? A lot of them are agricultural companies. Maybe one of them would pay. Maybe one of them would agree to sponsor biochar. "Now a public service announcement about biochar from Company XX." Nothing asked, nothing gained. Or, as the Bible says, "Ask and it shall be given."

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Strong Visual Posters

This one is easy. Where are the best artists in any community? In school. So ask your teacher friends. Would they let you talk to their students about biochar and then have them make posters? Maybe you could find a little money to make it a competition. Maybe the winning school gets free biochar fertilizer for a school garden. What about art students at university?

Inexpensive t-shirts

First, you need the design; then, you need the t-shirt. The design part is easy. It is just like the posters. The t-shirt part may take begging the company to give you a discount or free t-shirts, or asking different churches, for example, to donate to buy the t-shirts for this or that village training.

Remember: This is all about your imagination –

and imagination doesn't cost anything!

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**Alone, we are weak. Together, we can move the earth.
Biochar: A natural soil amendment and tool to combat climate change**

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Sisters rejoicing at the many oranges on a biochar fertilized tree.

What are the main uses of biochar?

Making biochar is for our own goodness; biochar doesn't need us but rather we need it. Thinking of what biochar can do, it is clear that it is not only to benefit farmers but the whole of humanity as its uses range from cooking to

Biochar's uses in farming

- Soil amendment
- Plant health assistance
- If there are pests or other harmful chemical in the soil, as shown in the picture to the right, biochar can protect the plants from being eaten or infected.

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Such healthy eggplants!

- Silage agent
- Feed additive supplement: Animal Health assistant. When animals like cows, chickens, goats or pigs are fed biochar, the biochar will help to keep them healthy. Weight gain assistant – animals fed biochar will gain more weight faster.
- Litter additive



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Biochar fed cows. Biochar mixed manure.



Biochar added to the litter in chicken barns reduces the smell, reduces fighting and becomes a good fertilizer.

Manure mix/slurry treatment

Water treatment, fish farming

Biochar cleans the water by collecting the nitrates and nitrites in fish poop that will make the fish sick. When you use the biochar in your garden later, these are good for the plants.

Soil/water decontaminant

Used widely as soil amendment, biochar "locks up" poisons in the soil so that they cannot get into the water or up to

Disease vector suppressant.

Used in chicken and cow barns, and in pigpens, biochar reduces smell and flies, limiting disease transmission.

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Ecological benefits to using biochar



Biochar can be a simple yet powerful tool to combat climate change and clean the environment. It plays a dynamic role in humanity's future. Using it helps to:

- Maintain balanced moisture levels, even in the face of rapid climate change
- Reduce burning and fire damage to soil, plants, birds and animals.
- Cut air pollution (smoke, smog, black carbon)



- Improve soil carbon and enrich soil life.
- Detoxify poisoned soils, for example, near dumps or chemical stores.

One of the things that I like most about biochar is that making and using it encourages each of us to think about our world and to take environmental and social responsibility.



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This girl should be in school.

Cooking

In East Africa, many people use maize cobs biochar for cooking instead of using charcoal because charcoal sometimes can be very expensive whereas biochar is very easy to make and it is free since we only recycle the waste materials. Cooking with biochar can:

- Save money
- Save women's time – do not waste it scavenging for wood.
- Send girls to school, not to fetch wood.
- Stop deforestation – cook with crop waste not wood.
- Clean the air – biochar does not smoke like wood.

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Making Biochar [Editor's gloss]

Sr. Paulette recognizes that small farmers are poor, busy and malnourished. They cannot afford to buy or make expensive machines. They do not have the time to spend doing something that will take too much time. During the dry season, there is not enough food and most people are not strong enough to do hard tasks.

Sr. Paulette also knows that small farmers do not trust governments' or outside organizations' promises. They promise a lot, they seldom follow through. Even when they do, they will soon abandon you. Self-sustainability is key.

When Sr. Paulette's thinks about biochar, she thinks about these concerns. As she has developed her approach to making biochar and using biochar, she has consulted with the very poor farmers who gather at her convent for help.

Her approach meets their concerns and needs. Her designs and her biochar products are never truly finished; they change and improve with input from poor farmers everywhere she works and from every one of the Warm Heart East Africa sites she manages.

Sr. Paulette's equipment is cheap, even free. Unlike traditional charcoal production that takes a week, her process is fast, taking only 10 minutes to an hour. It is also more efficient, yielding 20-30% char instead of the traditional 7%.

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Very important, Sr. Paulette reports, biochar is easy to make and requires no outside help once a farmer learns the basics. The biochar program reduces poor farmers' dependence on outside help and on costly outside inputs such as fertilizer. Her theme is: "No more waiting. You can help yourself now."

Biochar making machines [Editor's gloss]

Sr. Paulette teaches farmers to make and use one of two biochar making machines, depending on the crop waste they want to char. The first is the so-called barrel TLUD (Top Lit, Up Draft) machine and the second the aptly named "Trench."

The Barrel TLUD (Top Lit Up Draft) Biochar Machine



George, the convent's handyman, with the first two TLUDs he built

The TLUD Sr. Paulette uses is a variant of a well-tested technology developed years ago and known as the Jolly Roger or JRo for the man who first invented it. The TLUD has been modified often to make it more efficient and cuter.

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When Warm Heart redesigned it, the aim was to cut cost, material, tool and time requirements. Dr. Karl Frogner perfected the final design, now widely used in Southeast Asia and Africa. Click [here](#) to view a 5-minute video that provides complete instructions. A novice can make a Frogner TLUD in an hour and a half.

The TLUD makes excellent char from corncob and similar, chunky feedstocks. It will not work with feedstocks such as rice husk or coffee hulls that pack densely. It makes good char with straws, stalks and branches, but feeding enough them to a TLUD or cutting them to fit is time consuming and laborious. Better to use a trench.

Because the countries of East and Central Africa grow a great deal of corn, Sr. Paulette has made the TLUD her technology of choice. Corn is de-kernelled on the farm, leaving farmers with the cob to char.

Corn cob char is excellent for cooking. It lights easily, does not smoke or smell (it solves the killer cooking fire problem clean stoves are supposed to solve, but that are neither available nor affordable for poor farmers), burns hot and clean (no black mess to scrub off the bottoms of pans).

If water is not available, a TLUD can be smothered by setting it in dirt and packing dirt around the secondary air vent at the top. Sr. Paulette reports that farmers all have water at their farms and can quench their char with water.

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The Trench (with or without roofing sheet)



The Trench is an inelegant, zero-cost “technology” for making biochar in the field with feedstocks that do not work in a TLUD – straws, stalks, bamboo, branches and without having to collect and carry them to a central charring location.

The Trench is literally that, a trench dug in the ground. It comes in two versions, neither of which requires water, both of which can be made in the field adjacent to the crop waste.

In the first, the Trench is dug slightly shorter and narrower than a standard sheet of roofing metal. When the Trench is full of biochar, the roofing sheet is set on top and the edges sealed with dirt.

The biochar is left to smother. In the second (where roofing sheet is too expensive), when the Trench is full, the biochar is simply covered with dirt that is packed down and left until the char has smothered.

Detailed, Illustrated instructions for making and using a trench that include Sr. Paulette’s modifications can be found [here](#) and an article about the trench [here](#).

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Spreading the Word about Biochar in East Africa

Biochar is a new technology to many people in East Africa, but so far with the help of our staff here at the convent in Zomba and good friends in Malawi, Burundi, Kenya, Uganda and Zimbabwe who are great lovers of biochar, we have managed to introduce quite a good number of people to this amazing life changer technology.

I want to tell you just a few of the wonderful stories about how people have welcomed biochar and how using biochar has helped them.

Malawi: Our Home Base

Use of biochar is gaining momentum in Zomba and other parts of the Malawi.

We started at the convent where we taught ourselves to make biochar by reading materials and watching videos on the [Warm Heart website](#).

Some of the farmers who attended services at our church asked if they could learn to make biochar. They were very happy with the results and became our testers. Whenever we had a new idea, they would test it for us.

We have also introduced biochar to some of the students in the colleges in Zomba and in Blantyre. Some of the students have in turn offered to share the knowledge gained with their colleagues and to take it home to share with people in their villages.

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Because we tried everything first in Zomba, the sisters at the convent and our farmers have experience with everything. They know how to make biochar. They also know how to make fertilizer and animal feed with biochar. They are all happy with the results.



The Sister using biochar in the convent garden



Lots of oranges on the convent's old orange tree – after biochar!

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Healthy eggplants, no bugs!

Beyond Malawi

I have been blessed to be able to travel to Nairobi and to meet other Sisters from all over Central and East Africa.

I have told them about biochar and many have taken the idea of biochar home with them to their convents in Burundi, Kenya, Tanzania, Uganda, Zambia and Zimbabwe.

They have made their convents into centers of learning and testing and teaching like our convent in Zomba. They too are sharing the knowledge with the farmers around their monasteries because biochar is just too good to keep to oneself.

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At their convent's, they are also experiencing the same wonderful results that we are. Farmers are coming to them to learn and are going home to use biochar and teach others.

Biochar seems truly to be a miracle. It is bringing so much good to so many who were so poor and without hope. Those who are using biochar have experienced a great positive change as seen in the photos below.

Gardens are greener. There is more fruit on the trees. The corn is taller. The chickens, cows and pigs are fatter. The rabbits are healthier.

Here are some of the things our friends are doing.

In **Kenya**, the nuns use biochar in feed for their cows and pigs and spread it on the manure piles and the ground to help reduce smell and flies.

They say that their animals are healthier and that there are fewer flies.

They also grow rabbits at the convent. Their rabbits were very sickly until they fed them biochar. Now the rabbits are healthy and growing.



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In **Uganda**, farmers are adding biochar to the banana and fruit trees. According to them, the bananas planted with biochar have produced big bananas. They say that pawpaws planted with biochar produce more and bigger fruit. They sent these photos to show me how well things are going.



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Zimbabwe:

Like a spark of fire, biochar has reached some areas of Zimbabwe and we have received good feedback from our friends whom we taught about biochar and are also enlightening others on the same. They are using biochar to feed their animals like chickens and quails.



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Thank you.

I hope that you will share this knowledge with others and that their lives will be better because of it. Warm Heart is not a religious organization but I am a Catholic nun, so I can say, "Go with God."

God bless you,

Sister Miriam Paulette

For more information about [Biochar](#) visit our website. We have DIY videos on how to build an oven, and how to use biochar.

To support Sister Miriam's effort to spread Biochar across Africa you can make a donation on [Global Giving](#).