Making a difference with fungi: Eco Agric Uganda

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Residing as I do in the globally connected metropolitan hub of London, England, I am confronted daily with the staggering forward leaps in mycological exploration. Fungi fairs, forays, and festivals occurring weekly, showing us the latest developments in myco-materials, medical sciences, culinary arts, mycoremediation, and so on. I am left without doubt that fungi are here to save the world! All exciting and compelling stuff, but my sporadically inflexible mind has often struggled to make the leap from theoretical—perhaps even abstract—lab-based notions, to real-world large-scale impact. It wasn't until a trip to a tucked away corner of Uganda in East Africa that the real-world impact of mushrooms was truly brought to light for me.

Located on the shores of Africa's largest lake, the mighty 'Nnalubaale (Lake Victoria), and playing host to both the source of the Nile and a section of the equator, Uganda is most famous for its incredible variety of fauna. This is a major destination for gorilla and chimpanzee tracking as well as being home to over 1,000 species of birds. More than 5 million tourists flock there every year, but very few, if any, are travelling to explore the country's extraordinary offering from the kingdom of fungi.

In the Western world, we tend to speak of mycophilic and mycophobic cultures to differentiate between countries with a healthy enthusiasm versus a healthy fear around mushrooms. Uganda isn't so much mycophobic, as myco-ambivalent. Commercially cultivated button and oyster mushrooms form a small part of the national diet, as well the odd locally foraged species sold in markets. Mushrooms have enjoyed a gentle increase in popularity over the past decade as they are considered a solid substitute for meat, the far more costly option. One Ugandan who has wholeheartedly embraced mycology and has long been extolling its virtues, however, is the ebullient Josephine Nakakande, founder of Eco Agric Uganda, an NGO using mushrooms to help thousands of women living below the poverty line. She is also an excellent mushroom cook to boot!

Josephine's life story has informed her altruistic outlook. During a recent visit to Uganda, I had the great privilege of spending three weeks in the company of Josephine and her family, learning from their practice whilst making myself available to help out wherever possible. My journey began at

the family home in the Wakiso District just outside Kampala, where I sat down with Josephine to hear about the origins of the organization.

Born to a teacher and a housewife, Josephine lived a very poor childhood as one of eight kids. Early in their life, her mother took the bold decision to step out of the prescribed gender-normed tasks of a housewife and started growing plants on a tiny plot of land that the family had access to near her husband's school. Her first crop was beans, which Josephine fondly remembers as her first real memory of a treat—although she now professed to hate them! Gradually, she moved up to vegetables, which would sell in small quantities creating a second albeit small source of income to the house. The extra cash eventually enabled her to graduate to chickens. Josephine relates an especially heartbreaking episode: when the chickens started laying, her mother washed the eggs and kept them warm in millet grain before selling them, but of course, they rotted. This meant Josephine would have to go another year without sandals; she wouldn't own a pair of shoes until the age of 12.

One fine day, Josephine's mother was able to afford a cow—this seemingly innocuous purchase was in fact riddled with controversy as a woman owning a cow was considered highly irregular, not to mention that during the 1986–1994 Ugandan Civil War, being in possession of a cow might single the owner out as a Karamoja cattle-raiding rebel—and therefor an enemy of the government. But Josephine's mother loved the cow, so she took the risk of hiding it. This was until Josephine eventually reached high school age and her mother was forced to sell her beloved animal to pay for Josephine's education. A sacrifice Josephine would never forget.

Once at boarding school, Josephine was bullied and mocked for not having sandals and a towel for the showers. Eventually, two kind girls came together to share their towels and sandals with her.

Inspired by her mother's chicken and cow adventures, Josephine studied veterinary sciences and animal husbandry before going on to earn a PhD in organizational management in 2007. At university, she met Robert Muwawu; they would promptly fall in love and marry. Together they started Eco Agric Uganda. Their mission was to help empower women to grow food just like Josephine's mother. When telling me this moving story, she concluded "I help the women of Uganda as a way of thanking those two girls who helped me out at school."

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Eco Agric Uganda's mission is to empower women and girls living in poverty in rural Uganda by helping them learn agricultural skills, in particular mushroom growing. Mushroom growing is especially impactful. Anyone who has kept a block in their bathroom or cellar will tell you, it's cheap, quick, and very easy; definitely cheaper, quicker, and easier than growing vegetables. Eco Agric runs a mushroom center in Hoima, a city in the Western Region of Uganda, where they make growing blocks (or gardens as they more poetically call them). They then distribute these around the local area, giving women the opportunity to grow their mushrooms with zero overhead costs so they can eat and sell them, creating both income and food security, neither of which are otherwise guaranteed.

Predominantly growing grey and golden oysters, Josephine also indulges a few experiments including king oysters, shiitake, and her favorite, lion's mane.

After Kampala, I travelled with the family to Hoima where the Eco Agric Uganda headquarters are located alongside the growing center, the beating heart of the operation. As well as housing the garden production line, it is also used to train young girls in mushroom growing, setting them up with a new skill early in life.

Here I met three of the girls: Odetta, Helen, and Evelyn. They are permanent residents in the Hoima compound who are charged with the upkeep of the mushroom growing facility as well as building the growing blocks from scratch. Limited resources make this an especially laborious process. Substrate is bought from local farmers; these include cotton and rice husks as well as banana leaves collected from the Eco Agric compound. The substrates are then sterilized with ash. This is a

simple case of burning loads of wood and mixing it with water, thus raising the water's pH levels, creating an alkaline solution which inhibits any unwanted bacteria. The substrate is then drained, inoculated with grain, and stuffed by hand into poly tube (all synthetic materials are sterilized with bleach). The bundles are then packed into three 210 L steel drums leaving a gap at the bottom for water. A fire is lit beneath the drums creating steam which further helps sterilize the blocks. Once completed, the gardens are stacked, ready for distribution. These will go out to women all across the Western Region and further afield.

The laborious manual process is made additionally difficult by the fact there is no running water available in the compound. Water is collected in 20 L jerricans from a source about a mile down a hill and gracefully carried home on heads up the hill, or, in your humble author's case, very ungracefully and with many breaks and much spillage!

The blocks are kept in a growing room, a rudimentary concrete building with wooden shelving kept cool by a banana leaf ceiling. During my trip, I was very impressed by the insulating properties of dried banana leaves. Josephine showed me the huts they used to use before their current setup, these consist simply of a wooden frame covered in dried leaves. The temperature difference when standing inside one of these little huts is astounding.

The growing building also is comprised of a small lab with a pressure cooker and a fridge. These were afforded by donations. As an NGO, Eco Agric are reliant on charity donations and support from a variety of patrons. There is also a semi-sterile dark room where the spawn lives alongside Josephine's lion's mane experiments.

Hearing of my mushroom growing habits back in London, Josephine tasked me with leading a lime-sterilization experiment. If successful, this would save them money as lime is cheaper than the wood they burn for ash. I was heartened to later hear our experiments were successful.

Josephine and Robert have amassed an incredible amount of skill and knowledge over the years. Learning through trial and error, and a global community of advisors Josephine has fostered over Zoom and Instagram, but they are still faced with the limitations of poor resources. They are always looking for contributions, be they financial or advisory. Indeed, Josephine has organized what she has named her "committee," a network of fungi friends from various backgrounds who meet on Zoom once a month to advise and help trouble-shoot. She is also a formidable and highly entertaining presence on Instagram, posting daily videos about the mushroom farm as well as all other aspects of Eco Agric's work.

Other activities include running a school (San Martino Primary) with 300+ students in the rural Kibaale district, as well as funding education for girls who wouldn't otherwise be able to afford it. The school also hosts a vocational program for local youths setting them up with life-skills they can then pursue professionally. These include sewing, motorbike repairs, baking, and you guessed it: growing mushrooms!

Since its inception in 2007, Eco Agric has been able to help thousands of women and children by harnessing the power of fungi. This is an instance where fungi are having a real social impact on the world, where we are working with them to help make a very real and very vital difference to people's lives.