

ENVIRONMENT

Finding a cleaner, and more sustainable fuel source from afar

UCSC student searches for new fuel source to help his African village

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SANTA CRUZ » Crowds filled the Kuumbwa Jazz Center last Friday as 11 UC Santa Cruz students prepared to take the stage.

Each year, the university hosts the UC Santa Cruz Grad Slam, giving graduate students the opportunity to share their thesis or dissertation work in three minutes or less. About a dozen judges critique each presenter's ability to communicate their research in plain language that's understandable to a general audience for cash prizes.

Santa Cruz Mayor Justin Cummings participated as a judge for the second year in a row. "It's inspiring to see the work coming out of UCSC," he said.

Eleven students approached the crowd during this year's Grad Slam. Midway through the program, Abel Mkulama made his way to the stage. Originally from a small village in northern Malawi, Mkulama moved to Santa Cruz in 2019 to begin graduate-level research at UCSC.

"I couldn't wait to grow up and get out of that village," he recounted during the introduction of his three-minute presentation on stage. But 10 years later, when Mkulama was away in college, he realized that he couldn't wait to get back home. He began searching for problems in his community, and was determined to focus his education and interests in science to improve the quality of life back home.

Soon, he found an issue worth solving — 98% of Malawians use charcoal and firewood for cooking, Mkulama explained. "Using these fuel sources can have terrible impacts on the environment and people's health."

Many homes in Malawi have dirt floors and small fireplaces indoors that women and children use daily, to cook food. But the current fuels used by most Malawians, Mkulama explained, cause indoor pollution.

"Burning firewood or charcoal releases tiny particulates into the air," he said. These particles enter the lungs of anyone nearby and can cause long-term health effects, such as pneumonia and tuberculosis.

Indoor air pollution is becoming so common, it is now being referred to as "the new silent killer" by some scientists, Mkulama said during his presentation.

The widespread use of



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Abel Mkulama delivers his three-minute presentation on a new sustainable fuel source idea.

firewood and charcoal for fuel has also led to massive deforestation.

"There are hillsides that used to be covered in trees when I was a kid, and now they're just open spaces," Mkulama said. As a result, soil erosion into local waterways and lakes is starting to jeopardize local tourism business and fishing livelihoods.

During his undergraduate studies in Malawi, Mkulama began to wonder about alternative fuel sources that are more readily available and less harmful to human health.

"Everyone in my village is a farmer," he explained. "So I wanted to see if something could be done with the leftover plant material after a harvest."

Now a full-time student with UCSC's unique Coastal Science and Policy program, Mkulama was able to put his idea to the test. He partnered with farmers in Malawi to build two prototype briquettes, both made from leftover corn husks and stems gathered from nearby rural farms.

The more successful of the two prototypes was made by shredding and slowly burning the dried corn waste in a metal drum. Mud was used to cover the top of the container to limit the amount of oxygen before burning it, and over time, the recycled corn stalks turned into a "charcoal dust."

Mkulama then experimented with different combinations of the dust and a corn-based glue, eventually finding the right mixture. Everything is mixed by hand and poured into a muffin tin-like mold. Once dry, small, spherical-shaped coals that burn just as hot as the currently-used charcoal are produced. Except Mkulama's version is made from sustainable materials and costs a fraction of price because it's manufactured locally.

"With this new formulation and process, we've cut out the middlemen that

transport the widely-used charcoal," Mkulama said.

Last week's Grad Slam event was Mkulama's first time presenting his work in only three minutes.

"English is not my first language, so having to think in one language and then speak in English for this presentation was a challenge," he said.

In the end, his efforts paid off — the judges scores, based on clarity, organization, delivery, visuals, appropriateness, intellectual significance, and engagement, were tallied and Mkulama's presentation earned second place.

He plans to use the \$1,500 prize, and additional funding, to distribute equipment across Malawi to further test the production methods of the sustainable briquette and lead workshops in rural villages.

"I'm the first in my country doing something like this, so next we need to prove that this model works," Mkulama said. "This project is all about seeing it through and empowering communities to do this on their own — the goal is to ensure sustainability."

Tori Klein, a fifth-year doctorate student received 1st place and the People's Choice Award at the recent UCSC Grad Slam for her presentation on "using zombie insects to find a cure for cancer."

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