The Terra Preta Project, Davis Peace Project Proposal 2014
Lamas Province, Department of San Martín, Perú
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The Problem: The indigenous Kichwa Lamista people lack a sustainable and fertile soil in which to grow food. Thus, they practice slash and burn agriculture like their mestizo counterparts in the Amazon region. Slash and burn not only causes irreversible environmental damage, but also fails to provide fertile plots of land to sustainably answer food demands. The burning process scorches the nutrients out of the soil, and each plot loses fertility after one to four years. After this short window of productivity, the small-scale farmer needs to abandon the depleted land to burn a new section of the forest. However, less and less land is available, which forces people to walk up to three hours daily just to reach their plots. Lack of fertile soil prevents the ation of permanent settlements and demands that farmers dedicate hours of additional travel time to access their plots. Because slash and burn agriculture is so unreliable and unsustainable, food security in the Amazon basin is low.

On a larger scale, slash and burn agriculture is one of the driving perpetrators of Amazonian deforestation. The department of San Martín in particular faces one of the highest national deforestation rates. Once covered by tropical forest and wetland, small-scale farmers have been the main perpetrators of the slash and burn agriculture[1]. In the past 50 years, over 1.6 million hectares of forest have been destroyed[2]. This accounts for about 30% of the total area. If the current rate of deforestation continues, the majority of San Martín's forest coverage will be destroyed by 2050[2].

Slash and burn agriculture fails to sustainably address local food needs and inadvertently imposes huge environmental consequences. Indigenous Kichwa Lamista communities need a sustainable and fertile soil in which to grow food as an alternative to slash and burn.

Proposed Solution: I propose a revival of "terra preta" production. "Terra preta" is an incredibly rich and carbon-absorbent type of compost that was used for thousands of years by indigenous groups. Terra preta is made up of four main components: organic matter, biochar, microorganisms, and broken ceramics. Terra preta has the potential to 1) grant food security for communities in the Amazonian basin 2) stop local deforestation and 3) reverse climate change.

With the Davis Peace Project, we can provide four interested indigenous communities with the start-up materials needed to begin producing their own terra preta. After the initial costs of constructing a biochar oven and training community members on how to make the soil, the communities will be able to autonomously produce unlimited quantities of their own soil at low or no cost. Once terra preta is made, it should be mixed at a 50% proportion with the existing soil each harvest for ten harvests. After these ten harvests (equating four to five years) the soil will be completely self-regenerating and fully fertile. If the top layer is removed, the soil will "grow" back because it includes microorganisms. At its full fertility, no additional terra preta needs to be added: the existing soil will remain fertile for thousands of years. This is evidenced by archeologist's findings of 3,000 year-old nutrient-rich living soil.

Environmentally, terra preta has the potential to prevent further deforestation, absorb massive amounts of carbon dioxide, and drastically reduce global warming rates. Terra preta sequesters huge volumes of carbon dioxide because of its inclusion of bio-char, or wood that is burned in a particular process without oxygen. If all the world's agricultural plots used terra preta, the global climate crisis would be reversed in five to six years[3].

Statement of Need: The reintroduction of terra preta production to indigenous communities is socially and environmentally transformative at a feasible cost. The Davis Peace Project Grant would cover the materials, labor, transportation, assembly, and training expenses for four biochar ovens as well as most of my travel expenses. Frederique Apffel-Marglin, founder of my partner organization, the Sachamama Center for BioCultural Regeneration (SCBR), explained the significance of having a biochar oven well. "Once the ovens are in place, the communities can autonomously and sustainably produce terra preta on their own. Currently they are able to do everything except the biochar, which is an indispensable ingredient. Building a biochar oven is simply beyond their means and it is beyond the means of the SBCR to build it for them…Having them be completely autonomous in the creation of this amazingly fertile and permanent soil is extremely important for spreading this forgotten ancestral technology to everyone in the community, to their own chacras [gardens], and not only to the one communal chacra."

The Partnership: I worked with Dr. Frederique Apffel-Marglin at the SCBR (Lamas, Perú) in the summer of 2013 where I learned about the importance of this indigenous soil technology. The SCBR is a non-profit organization led by Dr. Apffel-Marglin, Professor Emerita at Smith College and Distinguished Visiting Professor at Wesleyan University. She is very supportive of this application and it is our hope that partnering with SCBR to provide training and the Biochar ovens will help the local communities develop a sustainable way to grow food.

Planning and Logistics: The SBCR has collaborated with four Kichwa Lamista indigenous communities to create communal chacra-huertos [gardens] on depleted lands. My proposal requests funding to build one communal biochar oven in each of the four communities. The four Kichwa Lamista indigenous communities are Shukshuyaku; Solo; Molosho and Alto Pucalpillo. These communities range in size from 30 to 100 families. All of the materials for the biochar oven are made locally. The hearth and fan of the oven are repurposed auto parts, and the ovens are oil drums.

Randy Chung, the oven designer, will weld the metal oven components together in a local welder's shop in Lamas. Indigenous community members, along with help from the SCBR and myself, will construct the surrounding walls and roof of the oven. Construction of each oven will take about a week. To train four leaders from each community how to use the biochar over, the SCBR will cover room, board, and travel for this day and a half workshop that will take place at SCBR.

Once oven construction is complete and community leaders are trained, community residents will locally collect the free and renewable components of biochar. They will gather dried coconut husks, the woody fruit of the shapaja palm tree to use as fuel, and fallen twigs to start the fire. These components are abundant and easy to collect. The remaining soil components are accessible and low cost. To make one ton of terra preta soil, one needs 3 kg of raw hard craft cane sugar (less than $2) and 1 sack of rice polishings (about $8). The sugar and rice polishings ferment micro-organisms, which are gathered for free from the floor of a close-by area of rain forest.

Future Student work: Terra preta's fertility has proven to be invaluable and transformative, but there is a paucity of microscopic imaging of the microorganisms. Providing that microscopic analysis clearly showed terra preta's elevated levels of microorganisms and other indicators of fertility, this data would be substantial support for an adaption of it in the states. Particularly with this research, I think that Smith College would be in support of producing an adaption of terra preta in the states at their MacLeish Field Station in Whatey, Massachusetts. This hands-on opportunity for engagement would benefit Environmental Science & Policy Majors, Landscape Studies Majors, and Sustainable Food Concentrators. I additionally propose that while in Lamas, I collect three types of soil samples: terra preta, soil just after the plot was burned, and fully degraded soil. If this proposal is approved, I will apply for a permit to bring back terra preta (under form 526 from the USDA). I am already trained in operating Smith's Scanning Electron Microscope (SEM), a powerful microscope that can zoom in up to 50,000 times. For this research, I plan to use Smith College's Environmental SEM, which can examine samples with living organisms, like terra preta. Providing microscopic imagery to the college could catalyze its introduction to the states and would engage students from Smith and the 5 College Consortium. It would also drastically improve yields of both school-grown produce and that of domestic small-scale farmers. This research also has the potential to influence Peruvian environmental policy makers to advocate for terra preta as an alternative to slash and burn.

Concluding Statement: By providing biochar ovens for local communities, the Kichwa Lamista people gain a sustainable and fertile soil in which to grow food. This permanent agriculture assures local food security and helps eradicate slash and burn methods.

1. Expertanswer (Expertsvar in Swedish). "Effects of deforestation and expansion of agriculture in Peruvian highland jungle."
2. *ScienceDaily*, 24 Oct. 2011. Web. 17 Jan. 2014.*Conservation International: The Nested Approach to REDD+ in Peru...* Publication. Web. 10 Jan. 2014. <http://www.conservation.org/global/peru/publicaciones/Documents/norad_nested_approach.pdf>.
3. Apffel-Marglin, Frederique. In person interview. July 2013.