Carbon sequestration through growing permaculture food forests

Applicant Biographies

Brandon Eisler UNITED STATES NAVY DC2 (SW) (2003-2008), Temple University Student Living Development, Philadelphia PA (2008-2011) Ecological Tropical Research, Panama (2011-present) Brandon has been published in ecological journals and texts and has spent the last decade researching diverse ecological systems and the human-to-ecology relationship potential.

Kailee Howard New Mexico, New Mexico State University, IDN Field Studies,Bocas del Toro (2019-present)

Hailey G. Institute of Diverse Nutrition, Field Studies, Bocas del Toro, Panama (2021-present)

C.J. Howard Human Resources Coordinator at the Institute of Diverse Nutrition, Field Studies, Bocas del Toro, Panama (2013-present)

Seth Garbiel Gene Weaver 3.31.99 Newport News Virginia Institute of Diverse Nutrition, Field Studies, Bocas del Toro, Panama (2021-present)

The last member of our team would prefer to remain a "silent contributor," and we are open for new membership.

Proof of student status

"Letter of Enrollment and Support"

"Letter of Support"

Project description

What we propose is enhancing the capacity of current farmland and other lands to increase carbon capture using fungi's insects, animals, and specialized plant selections, diverse growing constructions, the techniques of permaculture and regenerative agriculture systems, and biodynamic agriculture preparations and soil treatments.

In the words of Bill Mollison, who designed the Permaculture Design Course,

> *"Permaculture is a philosophy of working with, rather than against nature; of protracted and thoughtful observation rather than protracted and thoughtless labor; and of looking at plants and animals in all their functions, rather than treating any area as a single-product system."*

Our motivation for deciding to work on farmland is manifold. Agriculture is currently responsible for about a quarter of net greenhouse gas emissions and thus significantly contributes to climate change [1]. This is due to the use and production of synthetic fertilizers, the use of fossil fuel-intensive machinery, soil degradation, and livestock [2,3c]. Furthermore, land conversion from natural ecosystems to agricultural land is linked to the loss of biomass above and below the ground [4].

A recent study [5] predicts 240 GtC uptake on 2020 Mha of land, a rate of 0.12 GtC Mha^{-1} over a 50-year period. At this rate, we'd need to convert around 83 Mha of agricultural land every year to reach the 10 GtC per year goal. At the end of the 50 year period, around 4.1 billion of the available 5 billion hectares used for agricultural land [4] would need to be converted.

The solution has also an indirect impact on CO_2 emissions from decreased fossil-fuel intensive machinery in agriculture, the industrial processes involved in the creation of said machinery, and chemical fertilizers. Since permaculture works with animals too, the meat, dairy, and egg industries will diminish their emissions.

We can extend the idea to not only use agricultural land. Another recent study [6] suggests that the planet can support an additional 900 Mha of forest without using agricultural land or living environments. If designed to be permacultural food forests, this new land could capture an additional 108 GtC at our estimated rate, and help feed the 2.2 estimated billion additional humans the United Nations estimates will live by 2050.

Literature to Support Approach

[1] Edenhofer, O.; Pichs-Madruga, R.; Sokona, Y.; Farahani, E.; Kadner, S.; Seyboth, K.; Adler, A.; Baum, I.; Brunner, S.; Eickemeier, P.; et al. (Eds.) Climate Change 2014: Mitigation of Climate Change; IPCC: Geneva, Switzerland, 2014; Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.

[2] Hathaway, M.D. Agroecology and permaculture: Addressing key ecological problems by rethinking and redesigning agricultural systems. J. Environ. Stud. Sci. 2016, 6, 239–250.

[3] Rojas-Downing, M.M.; Nejadhashemi, A.P.; Harrigan, T.; Woznicki, S.A. Climate change and livestock: Impacts, adaptation, and mitigation. Clim. Risk Manag. 2017, 16, 145–163.

[4] Food and Agriculture Organization of the United Nations. Land use in agriculture by the numbers. http://www.fao.org/sustainability/news/detail/en/c/1274219/. Accessed 30 Sept. 2021.

[5] V. K. Arora, A. Montenegro, Small temperature benefits provided by realistic afforestation efforts. Nat. Geosci. 4, 514–518 (2011).

[6] Bastin, J.-F., Finegold, Y., Garcia, C., Mollicone, D., Rezende, M., Routh, D., Zohner, C. M., & Crowther, T. W. (2019). The global tree restoration potential. Science, 365(6448), 76–79. https://doi.org/10.1126/science.aax0848

[7] Smith, P, Soussana, J-F, Angers, D, et al. How to measure, report and verify soil carbon change to realize the potential of soil carbon sequestration for atmospheric greenhouse gas removal. Glob Change
Biol. 2020; 26: 219– 241. https://doi.org/10.1111/gcb.14815

Project Plan

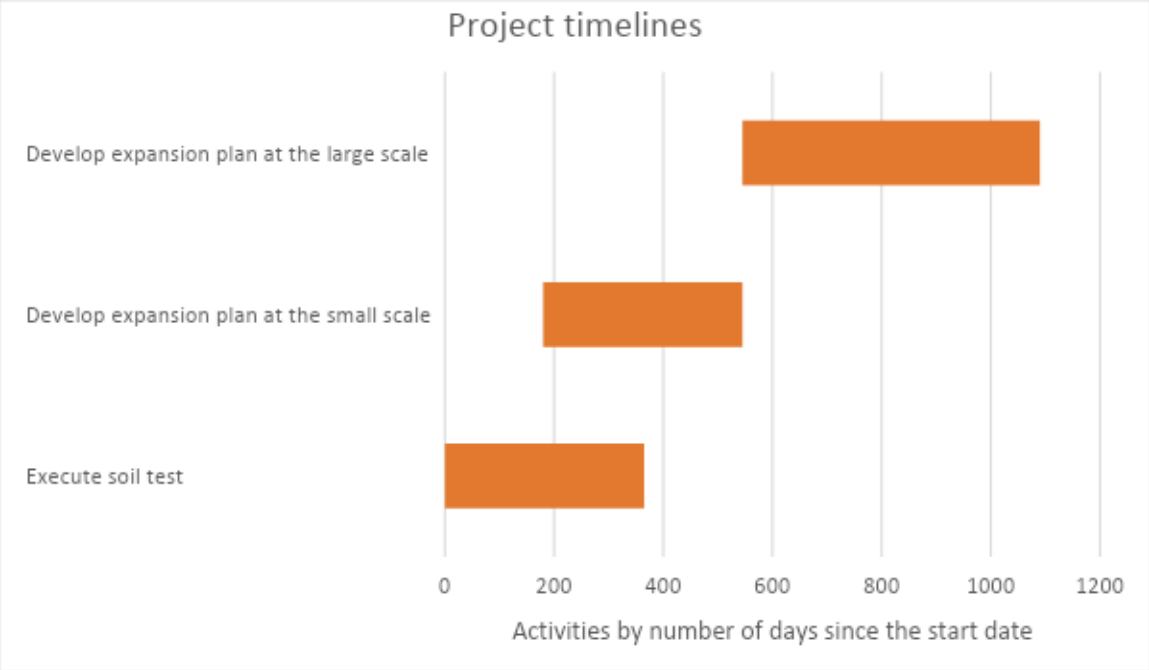
Our goal is to measure the impact of our team's work during the last 10 years turning around 20 hectares of residential land into permaculture food forests. To reach the 10^{-5}GtC scale, we would need to transform around 8.5 hectares of land. We believe that our farming during those years, along with the work to be done in the period of the competition, are enough to reach the scale required for the competition.

To verify this, we need a budget of $20,000 to measure the soil carbon change following the state-of-the-art recommendations in [7]. The budget includes testing of our food forests in Panama and Costa Rica during the duration of the competition, and immediate testing of residential land near each one to sue for reference.

During this period, we'd use an additional budget of $35000 to develop an expansion plan. This involves a detailed estimation of the costs to turn agricultural land into food forests at the very small to industrial scale. There is a range of possibilities in the scaling of permaculture that have to be adapted for the size and climate of a region. The budget would be used to fund research that can create these plans at a large enough scale to account for the 83 Mha of yearly transformation introduced in the project description.

From the start date, we'd expect to be done with the first soil tests by the six-month mark. This would give enough information to motivate the work of the project, comparing soil in our food forests with that of nearby residential land. After the initial soil

test, we'd put research efforts into developing the expansion plan for both the small and large scales. The gnat chart below shows our milestones.



Project Budget

Expense Sheet

Ability to execute

Past Projects:

- Costa Rica ND Center & Permaculture (2014-2016)

Installation of Permaculture in Costa Rica and development of study centers, living quarters, operations, resources, etc

- Colombia Excursion (2018)

A 3 month intense examination of the primary forest zones with a group of innovators and investigators from various backgrounds and organizations from around the world.

A detailed picture of the "Cattle Land Conversion," was drafted on this excursion and reaches in the final stages of completion today.

- Panama ND Center & Permaculture (2012-present)

Installation of permaculture and development of study centers, living quarters, resources, etc., in Boquete (Mountains) and Bocas del Toro (Island).

Contribution to: Addressing the climate change and poverty nexus (2019)

Published: Nutritional Diversity: An Abstract of All Natural Human Optimization (2020)

NutritionalDiversity.com Information Website draft/pilot (2021)

Our team has already recorded increased and potentially optimal performance results in injury recovery and athletic performance. We know our personalized optimization system also affects healing from, and resisting illness. These increases in performance and dramatically improved recoveries are based on a large diversity of robust species with a strong, dynamic method of highly-diverse organic vegetation cultivations.

These same biological principles of diversity, resistance, intelligent enhancement and others employed by our design apply to our ecological health as well.

Through the pursuit of overall health modeled according to nature's modeling we have discovered not only the carbon crisis solution, but the food crisis solution, and possibly even the waste crisis solution.

After ten years here in Central & South America we would like to think we work with a network of the upper echelon of innovative alternative naturalists and permaculturists in the region - which is currently exploding!

We are in an optimal region for our concept.

It is important to mention that in case we have been forced to leave major academia in order to follow an avenue of study that oftentimes is even "against the grain."

Once the working phases of "diverse species and motivators" are completed the next step would be a large-scale training operation. We would need to train the world's forces described in our proposal, and the XPRIZE winnings would certainly make that possible.

Academia has had a different mind-frame on biology than what the study of nature is finding in our team's case. This applies both to agricultural education and many other ecological studies as well have been limited to certain narrow focus and can follow interesting directions.

The opportunity to develop a new school of thought with worldwide training regarding this important and vital science would be the force behind it's actual full-scalability. This

‘very-large-scale’ level (Phase 4) by our current estimations would far exceed expectations in carbon capture, and also expectations of new budget monies needed.

Thank you for the opportunity to share our idea with you, and play our part to try and help the world do the right things!

Sincerely,

Brandon Eisler
‘Bio-Tribe’ XPRIZE TEAM
Team Captain