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Breadtree Farms

APPLICATION FOR STRIPE 2020 NEGATIVE EMISSIONS PURCHASE

Section 1: Project Info and Core Approach

1. Project name

Breadtree Farms

2. Project description. ***Max 10 words***

Conversion of annual cropland to sheep/chestnut silvopasture

3. Please describe your negative emissions solution in detail, making sure to cover the following points:
   a) Provide a technical explanation of the project, including demonstrations of success so far (preferably including data), and future development plans. Try to be as specific as possible: all relevant site locations (e.g. geographic regions), scale, timeline, etc. Feel free to include figures/diagrams if helpful. Be sure to discuss your key assumptions and constraints.
   b) If your primary role is to enable other underlying project(s) (e.g. you are a project coordinator or monitoring service), describe both the core underlying technology/approach with project-specific details (site locations, scale, timeline, etc.), and describe the function provided by your company/organization with respect to the underlying technology/approach.
   c) Please include or link to supplemental data and relevant references.

Max 1,500 words *(feel free to include figures)*

A) Breadtree Farms is a project development and farm management company. We are focused on establishing agroforestry systems focused on hybrid chestnut nut production. These systems integrate tree crops and grazing livestock as silvopasture systems, which sequester carbon in both soil and aboveground biomass. We have established 8 acres of silvopasture and will be establishing an additional 12 acres in 2020. Our anticipated growth based on our project pipeline is an additional 30 acres in 2021 (50 acres total), and 50-100 acres in 2022 (100-150 acres total). We aim to have over 1000 acres established by 2025. Our projected break-even on any given planting is 10-12 years, so financing the establishment phase is crucial to the rate of scaling.

B) Breadtree Farms primary role is establishing and managing carbon farming systems.

C) The following links are informative regarding the role of agroforestry and silvopasture in negative emissions goals:

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a) http://comet-planner.com/
    i) Comet Planner estimates 2.8 tons per acre per year in negative emissions for the conversion of annual croplands to permanent pasture with mulched trees.
b) https://www drawdown org/solutions/silvopasture
c) http://carbonfarmingsolution.com/carbon-sequestration-rates-and-stocks (notes these figures are listed as tons of carbon per hectare-year. This is equivalent to 1.44 tons of CO2 per acre per year.
    i) This site projects that silvopasture systems sequester 7.22 tons of CO2 per acre per year, and 361 tons of CO2 per acre in total carbon stocks.
d) In lieu of the 2016 Deep Decarbonization Report, which was published by the Obama administration and subsequently removed by the Trump Administration, this article cites much of the same research to articulate a path towards carbon neutrality. The original report from the Obama Whitehouse acknowledges the key role of agroforestry and silvopasture in the decarbonization of agriculture in the U.S.. Or as stated in this article. "According to a 2012 study, the widespread adoption of agroforestry practices in the United States could sequester 530 million metric tons of carbon dioxide equivalent each year, thereby transforming agriculture into a carbon sink."

Section 2: 2020 Net-Negative Sequestration Volume

See Stripe Purchase Criteria 1: The project has volume available for purchase in 2020.

4. Based on the above, please estimate the **total net-negative sequestration volume** of your project (and/or the underlying technology) in 2020, in tons of CO2. (Note: We're looking for the net negative amount sequestered here, net lifecycle emissions. In Section 3; you'll discuss your lifecycle and why this number is what it is).

56-140 tons of CO2

5. Please estimate how many of those tons are still available for purchase in 2020 (i.e. how many tons not yet committed). This may or may not be the same as the number above.

56-140 tons of CO2

6. (Optional) Provide any other detail or explanation on the above numbers if it'd be helpful. ***Max 100 words.***

In response to 3.C. we have listed the existing estimates for sequestration relating to this project. The responses in questions 4 and 5 are based on the range of sequestration between the low-end estimate derived from the COMET-Planner tool and the carbon sequestration rate for silvopasture provided by the meta-analysis in The Carbon Farming Solution.

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Section 3: Life Cycle Analysis

See Stripe Purchase Criteria 2: The project has a carbon negative complete lifecycle (including energy use, etc).

7. Provide a life cycle analysis of your negative emissions solution demonstrating its carbon negativity, as complete as possible given limited space, and making sure to cover the following points:

a) Include a flow sheet diagram of direct ingoing and outgoing flows (GHG, energy, materials, etc) that bear on the LCA.
b) Please be explicit about the boundary conditions of your LCA, and implications of those boundaries on your life cycle. Let us know why the conditions you've set are appropriate to analyze your project.
c) Make sure to identify assumptions, limitations, constraints, or factors that relate to ingoing and outgoing flows, citing values and sources (for example: land and resource scarcity, limitations on a required chemical, energy requirements). Also identify key sources of uncertainty in determining these values.
d) If your solution results in non-CO2 GHG emissions, please be sure to separately specify that (e.g. in units of GWP 20 or 100 years, ideally both).
e) For solutions that rely on modular components (for example: incoming energy flows or outgoing CO2 streams), feel free to cite values associated with those interfaces instead of fully explaining those components. For these values, please identify the upstream and downstream life cycle emissions of the component.
f) Explain how you would approach a more comprehensive LCA by citing references and underlying data needed for the analysis.

Max 1,000 words *(feel free to include figures or link to an external PDF)*

a) The major emissions related to the project other than the soil and biomass negative emissions, stem from the fuel use for farmer transportation to the farm and tractor usage on the farm.

Tractor usage for mowing the pasture occurs twice annually. The related emissions are:
2* .35 gallons of diesel per acre[1] * 20 acres * 22.4 pounds of CO2 per gallon of diesel [2]

= 314 pounds of CO2

In addition to this fuel usage, the only other significant source of emissions is the transportation of employees to and from the project. This will include 15 trips to the project this year from Breadtree Farms's office which is 180 miles roundtrip from the project. Each trip requires 6 gallons of gasoline. So, the total fuel usage annually is 90 gallons of gasoline. 1 gallon of gasoline produces 19.6 pounds of CO2. The total transportation emissions are 1764 pounds:

15 trips*180 miles/ 30 miles per gallon* 19.6 pounds of CO2 per gallon of gasoline[2]

= 1764 pounds

So the total emissions related to transportation and on farm vehicle use are **2078 pounds of CO2 or 1.04 tons of CO2.**

[1] http://www.waterandenergyprogress.org/library/05006.pdf
[2] https://www.eia.gov/environment/emissions/co2_vol_mass.php

b) This is a very low input project. As noted below (see question "f") there are some small additional contributions to the carbon footprint of this project, but the above accounting that includes Scope 1-3 emissions represents the bulk of it. We used boundaries that include Scope 3 emissions because the transportation footprint is over 80% of the project's footprint and it would be misleading to not include that component in an LCA.

C) If this was not answered as needed above, please clarify what further information you would like to receive on this topic.

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d) N/A

e) N/A

f) A more comprehensive LCA would include specific measurement of the rate of fuel usage for all operations, rather than industry standard estimates. Additionally, while the metal and plastic used to protect the trees is relatively low mass and should be allocated over the full 30 years of the project (rather than annually), a more comprehensive LCA would account for the production of those materials.

8. Based on the above, for your project, what is the ratio of emissions produced as any part of your project life cycle to CO2 removal from the atmosphere? For true negative emissions solutions, we'd expect this ratio to be less than 1.

1/56

Section 4: Permanence and Durability

See Stripe Purchase Criteria 3: The project provides durable, long-term storage of carbon.

9. Provide an upper and lower bound on the likely durability / permanence of sequestered carbon provided by your project, in years:

30-100 years

The durability of the annual sequestered carbon is greater than 100%. The carbon stock of this project will increase every year for at least the next 30 years as the trees grow, and the perennial pasture increases in health. The 30-year limit is conservative.

10. Please provide a justification for your estimates, and describe sources of uncertainty related to: the form of storage, effects of environmental or climatic variability, difficulty in monitoring or quantification, etc. Specifically, discuss the risks to permanence for your project, the estimated severity/frequency of those risks (e.g. 10% of the acres of forest in this forest type are burned by fire over a 100 year period), and the time-horizon of permanence given those risks.

Max 500 words

The variability in this estimate is based on the variability in biological systems. The rate of carbon sequestration in soils and biomass will be a direct result of the weather in 2020, the genetics of all plant matter, and the interaction of all species within that ecosystem. The range provided is based on available data of comparable systems as noted by the USDA National Resource Conservation Service and experts in the field of carbon farming. The risks of permanence to the carbon, once sequestered, are low. There will be some respiration of carbon back into the atmosphere on an annual basis, but it is reasonable to expect net-sequestration annually that offsets that respiration. Additionally, while climate change is leading to drought and fire impacts on other regions, these projects are located in the northeast U.S., a region which is

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predicted to receive more rain events with greater intensity in the coming years. For this reason the risk of fire that might disturb the sequestered carbon is very low.

Section 5: Verification and Accounting

See Stripe Purchase Criteria 4: The project uses scientifically rigorous and transparent methods to verify that they're storing the carbon that they claim, over the period of time they claim to.

11. Provide detailed plans for how you will measure, report, and verify the negative emissions you are offering. Describe key sources of uncertainty associated with your monitoring, and how you plan to overcome them.
Max 500 words

We will use the Woods End Laboratory methodology for testing the Total Carbon in the soil in April 2020 and April 2021 to calculate the net change in soil carbon. This will be added to a total aboveground biomass inventory using the U.S. Forest Service's Forest Carbon Inventory framework.

The major uncertainty associated with this monitoring strategy is that we are not currently planning to conduct deep soil testing within 2020. Breadtree Farms will conduct deep soil testing in the future, for the purpose of long-term tracking of the carbon cycling relating to deep rooted pasture species and trees. Depending on the funding secured through government grants, Breadtree Farms may establish a deep soil carbon baseline in 2020.

12. Explain your precise claim to ownership of the negative emissions that you are offering. In particular, explain your ownership claim: 1) in cases in which your solution indirectly enables the direct negative emissions technology and 2) when, based on the LCA above, your solution relies on an additional upstream or downstream activity before resulting in negative emissions. Please address the notion of "double counting" if applicable to your project, and how you'll prevent it.
Max 200 words

The concerns relating to ownership do not apply to this project because all sequestration within our projects is bounded geographically by land that we have legal rights to either via a lease or through purchase. Double counting would only be applicable to this project if Breadtree Farms violated contractual agreements and sold to multiple parties. This will be legally prohibited under any purchase agreement.

Section 6: Potential Risks

This section aims to capture Stripe Purchase Criteria 5: The project is globally responsible, considering possible risks and negative externalities.

13. Describe any risks or externalities, any uncertainties associated with them, and how you plan to mitigate them. Consider economic externalities, regulatory constraints, environmental risk, social and political risk. For example: does your project rely on a banned or regulated chemical/process/product? What's the social attitude towards your project in the region(s) it's deployed, and what's the risk of negative public opinion or regulatory reaction?

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Max 300 words

This is a very low risk project. The worst case scenario would be that a natural disaster (drought or tornado) would kill all of the trees that are planted. Even in this scenario, the permanent pasture that has been established would still sequester some portion of the estimated negative emissions. The lease agreement of the project protects Breadtree Farms from any interference from the landowners, and there are no relevant regulatory or public opinion concerns for a project of this nature. If anything, we have experienced a resounding enthusiastic response from the community and local governments which has already expanded Breadtree Farm's pipeline for 2021 projects.

Section 7: Potential to Scale

This section aims to capture Stripe Purchase Criteria 6: The project has the potential to scale to high net-negative volume and low cost (subject to the other criteria).

14. Help us understand how the cost and net-negative volume of your solution will change over time. Note that we aren't looking for perfect estimates. Instead, we're trying to understand what the long-term potential is and what the general cost curve to get there looks like. (Note: by "cost" here we mean the amount Stripe or any other customer would pay for your solution):

	Today	In ~5 years	In ~20 years
Est. Cost per net-negative ton (in $)	100	75	50
Est. Net-negative volume (in tons of CO2)	98 (20 acres)	4,900 (1,000 acres)	49,000 (10,000 acres)

15. What are the drivers of cost? Which aspects of your costs could come down over the next 5 years, and by how much? Do you think your eventual scale potential is limited by cost or by volume? Why? Refer to any relevant constraints from question #7, like land or materials scarcity, and specify the boundary conditions for which you consider those constraints.

Max 300 words

The main drivers of cost are the purchase of seedling trees, the protective tubing for young trees, and the cost of labor for planting the trees. The average cost per acre in year 1 of each project is $3,500. The cost of trees is the only driver that can be significantly reduced at scale. As Breadtree Farms's operations expand, we will grow our own trees from seed. However, as the first plantings begin to yield chestnuts and produce agricultural revenue, they will offset the establishment costs of new acreage, which will allow us to reduce our costs for carbon.

Ultimately the rate at which we scale is more limited than the absolute cap on our scale. Within the northeast U.S. there are well over 1 million acres of farmland suitable for our projects, but the rate with which we acquire and plant trees on this land is limited by our ability to fundraise and generate revenue via carbon sequestration and agricultural production.

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Section 8: Only for projects with significant land usage

See Stripe's Purchase Criteria 2: The project has a net cooling effect on the climate (e.g. carbon negative complete life cycle, albedo impact, etc.) ***This section is only for projects with significant land usage requirements: Forest, Soil, and BECCS/Biochar/Biomass sequestration projects.***

16. Location: Please provide baseline information about the geographic location(s) of your project; and link shapefile(s) of project area(s).

Max 100 words

Breadtree Farms first project is located on Otter Creek Road, Johnsonville, New York.

Breadtree Farms.kml

17. Land ownership: Please describe the current (and historical as relevant) land ownership and management for the area(s) provided in (16). If your project is not the landowner, describe your relationship to the landowner.

Max 150 words

Breadtree Farms is the project owner and holds a lease with a 30 year term on this land. The 20 acre project is located on a 450 acre farm that is protected from development by a State owned trust, so there is low risk of disturbance of the site even after the end of the lease term.

18. Land use: For forest projects, please provide details on forest composition as well as forest age and basal crop area/density. For soil projects, please provide details on land use and crop type (if agricultural), soil organic carbon baselines, and regenerative methodology. For BECCS, biochar, or wooden building materials projects, please provide details on biomass crop type and methodology as applicable.

Max 500 words

This project is the conversion of former corn and soy crop fields into permanent sheep pasture with the integration of hybrid chestnut orchards. The entire system is organically managed. The total soil carbon baseline will be collected in the coming month using the Woods End Laboratory Total Soil Carbon methodology.

19. Net effect on climate: Please discuss the non-CO2 impacts of your project that may not be covered in your LCA, such as your impact on albedo.

Max 150 words

The reduction in the use of nitrogen fertilizers associated with the previous cropping system will reduce the annual NO2 emissions for the project. The albedo or other effects of this project have not been researched.

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Section 9: Other

20. What one thing would allow you to supercharge your project's progress? This could be anything (offtakes/guaranteed annual demand, policy, press, etc.).

Max 100 words

Increased funding support (debt or equity), and/or a purchasing agreement that allowed Stripe or other stakeholders to purchase 10-30 years of negative emissions at the start of each project would supercharge this project's establishment on more acreage.

21. (Optional) Is there anything else we should know about your project?

Max 500 words

Thank you for your consideration. I apologize for the brevity on certain answers, please do not receive it as a lack of interest or intentional vaguery. While I am committed to producing negative emissions through chestnut farming, I am a farmer first and foremost and was not able to respond to the requested detail and quick turnaround to the extent I would have liked while upholding my operational needs. I will be happy to reply to any follow-up questions or requests for more information.

Section 10: Submission details

*This section **will not** be made public.*

22. Please insert below the name and title of the person submitting this application on behalf of your company (or, if you are submitting this application on your own behalf, your own details). By submitting this application, you confirm that you have read and accept the Project Overview (available HERE), as well as the further conditions set out below. As a reminder, all submitted applications will be made public upon Stripe's announcement. *Once you've read and completed this section, submit your application by March 20th by clicking the blue "Share" button in the upper right, and share the document with **nets-review-2020@stripe.com**.*

Name of company or person submitting this application

[redacted]

Name and title of person submitting this application (may be same as above)

[redacted]

Date on which application is submitted

[redacted]

We intend to make the selection process as informal as possible. However, we do expect that (a) the content of your application is, to the best of your knowledge, complete and correct; (b) you do not include any content in your application that breaches any third party's rights, or discloses any third party's confidential information; (c) you understand that we will publicly publish your application, in full, at the conclusion of the selection process. You also understand that Stripe is not obliged to explain how it decided to fund the projects that are ultimately funded, and - although extremely unlikely - it is possible that Stripe may decide to not proceed, or only partially proceed, with the negative emissions purchase project. Finally, if you are selected as a recipient for funding,

Stripe will not be under any obligation to provide you with funding until such time as you and Stripe sign a formal written agreement containing the funding commitment.