BOOMITRA CARBON FARMING IN THE INDO-GANGETIC PLAINS

Document Prepared by ConserWater Technologies Inc DBA Boomitra

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1 PROJECT DETAILS

1.1 Summary Description of the Project

This project intends to help farmers adopt new improved agriculture practices in the Indo-Gangetic Plains of the Indian subcontinent. Improved agriculture practices include crop residue management, natural farming, crop rotations and more, which enable cropland soils to improve their carbon sequestration capabilities. The region contains large numbers of small and marginal farmers[1] who are highly susceptible to reductions in yields arising from climate change[2], and there is a strong need for programs and interventions to help them adapt.

Over the past several decades, an intensive agricultural process focused on maximizing yields every year has led to a gradual degradation of the soils of the region, resulting in CO_2 emissions from the lost soil carbon. Additionally, certain highly unsustainable practices have become mainstream in recent decades, such as the burning of crop residues as an effective way to clear out fields for planting for the next season, which occurs in quick succession after the previous season. Burning crop residues can cause further soil degradation by not only denying the soil of carbon additions but also inadvertently incinerating some of the carbon that is already in the soil, resulting in net GHG emissions. It also leads to significant particulate air pollution throughout the Indo-Gangetic plain, which is detrimental to human health and leads to nearly 66,000 deaths yearly[3].

Climate change has also led to much warmer weather in this region, which has caused soil carbon to naturally decline, as enhanced bacterial activity leads to decomposition. These declines are not matched by equal increases in reincorporation of biomass into the soil, leading to further soil carbon loss. These trends have made the Indian agriculture sector one of the key sources of greenhouse gas emissions in the country. In addition, they make farmers of this region especially vulnerable to climate change – yields from degraded lands are much more susceptible to severe weather and climate variability.

In this context, improved agricultural practices provide the opportunity and the power to reverse this land degradation and return carbon to the soil, creating carbon removals while improving overall soil health. In this project, farmers adopt a variety of improved agriculture practices. These practices are proven ways to increase soil organic carbon, and enable farmers to improve their productivity: increases in soil organic carbon improve the ability of soils to store moisture and nutrients, and thus also help to increase yields. Boomitra's research has shown that farmers face various barriers in the adoption of these practices, and

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[1] Panda, Chandan & Singh, S. (2016). Marginal and Small farmers' Climate Change Perception and Adaptation. 9. 839-846. 10.5958/2230-732X.2016.00108.X.

[2] Rao, S., Prasad, R. and Mohapatra, T., 2020. *Climate Change and Indian Agriculture: Impacts, Coping Strategies, Programmes and Policy*. [ebook] New Delhi: Indian Council of Agricultural Research. Available at: <https://naarm.org.in/wp-content/uploads/2020/06/ICAR-NAARM-Policy-on-Climate-Change-and-Agriculture_compressed.pdf> [Accessed 3 February 2022].

[3] Center for History and Economics, Harvard University. 2021. *Visualizing Climate and Loss: Crop Residue Burning in India*. [online] Available at: <https://histecon.fas.harvard.edu/climate-loss/crops/index.html> [Accessed 3 February 2022].

this project works towards helping farmers to surmount these barriers, while working with partners to create feasible and sustainable solutions that promote behavioral change at the grassroots level. The financial benefits from carbon credits will provide a direct boost to the livelihoods of these farmers, many of whom are small and marginal farmers.

In addition to increasing Soil Organic Carbon (SOC) in croplands, this project is expected to generate several community benefits and contributes to the following UN Sustainable Developmental Goals (SDG):

1) SDG Goal 1: End Poverty
2) SDG Goal 2: Zero Hunger
3) SDG Goal 3: Good Health and Well Being
4) SDG Goal 6: Clean water and sanitization
5) SDG Goal 8: Decent work and economic growth
6) SDG Goal 13: Climate Action
7) SDG Goal 15: Life on Land

This project only quantifies carbon removals from new project activities (improved agricultural practices) using the VM0042 methodology. We estimate an initial yearly greenhouse gas (GHG) removal of approximately 200,000 tons of CO_{2e} from this project, and the number of farmers participating in the program is projected to grow over the course of the crediting period.

1.2 Sectoral Scope and Project Type

Sectoral Scope	14. Agriculture, Forestry and Other Land Use (AFOLU)
AFOLU Project Category	Agriculture Land Management (ALM)
Project Type	This is a grouped project.
Improved Cropland Management (ICM)	This category includes practices that demonstrably reduce net GHG emissions of cropland systems by increasing soil organic carbon stocks,

1.3 Project Eligibility

The proposed project meets all the requirements set forth in the VCS Standard, VCS program and VCS methodology VM0042 "Methodology for Improved Agricultural Land Management", Version 2.0, dated 21 December 2021, which is under development[4].

This is a voluntary project with the objective of promoting improved agricultural practices in the project area. Furthermore, to describe and justify how the project is eligible under the scope of the VCS Program, we use the criteria listed in section 2.1.1 of the VCS standard, V4.1, outlined in detail in the table below:

[4] https://verra.org/wp-content/uploads/2021/12/VM0042_v2.0_FinalDraft_PublicComment.pdf. This methodology is under development and is open for public comment from 23 December 2021 until 5 February 2022.

Criterion	Fulfilled (Yes / No)	Justification
The six Kyoto Protocol greenhouse gases.	Yes	The project results in GHG removals through soil organic carbon sequestration, removing CO_2 from the atmosphere and storing it as soil organic carbon in cropland soils by adopting regenerative agriculture practices.
Project activities supported by a methodology approved under the VCS Program through the methodology approval process.	Yes	The project activity is supported by the VCS methodology VM0042: Methodology for Improved Agricultural Land Management (version 2.0), which is under development as per the VCS Program methodology approval process.
Project activities supported by a methodology approved under a VCS approved GHG program, unless explicitly excluded under the terms of Verra approval.	Yes	The project activity does not belong to any project categories that are excluded by VCS from being part of the VCS program.
Jurisdictional REDD+ programs and nested REDD+ projects as set out in the VCS Program document Jurisdictional and Nested REDD+ (JNR) Requirements.	Not Applicable	This is not a Jurisdictional REDD+ program, hence this eligibility criterion is not applicable.
Ozone-depleting substances.	Not Applicable	The project activity does not involve any ozone-depleting substances

1.4 Project Design

☐ The project includes a single location or installation only

☐ The project includes multiple locations or project activity instances, but is not being developed as a grouped project

☒ The project is a grouped project

Eligibility Criteria

Inclusion Criteria for new project activity instances

The following table describes the minimum general eligibility criteria to be satisfied by new instances and evidence for how every criterion is fulfilled as per paragraph 3.1 of VCS Standard v4.2.

SL No.	Eligibility Criterion	Description / Required condition	Means of Verification / Supporting evidence for inclusion
1	Meet the applicability conditions set out in the methodology applied to the project.	As per VM0042 version 2.0, each new project activity instance must demonstrate compliance with the applicability conditions set out in the methodology.	Section 3.2 of the PDD must have all the details pertaining to applicability conditions.
2	Use the technologies or measures specified in the project description.	All the new project activities shall implement one of the activities mentioned in the project activity description in Section 1.11 of the PDD	Section 1.11 of the PDD must select one of the project activities listed in section 1.11 of the registered PDD.
3	Apply the technologies or measures in the same manner as specified in the project description.	Each project activity instance shall adhere to the technology specifications (mentioned in methodology / standard) employed by project activity.	Section 1.11 of the PDD must select one of the project activities listed in section 1.11 of the registered PDD and explain in detail how criteria has been met with respect to technology specifications, standard sizes, etc.
4	Are subject to the baseline scenario determined in the project description for the specified project activity and geographic area.	Each new Project Activity Instance must demonstrate that the baseline scenarios comprise one or more of unsustainable agriculture practices.	Relevant sections of the PDD must clearly define baseline conditions related to unsustainable agriculture practices.

SL No.	Eligibility Criterion	Description / Required condition	Means of Verification / Supporting evidence for inclusion
5	Have characteristics with respect to additionality that are consistent with the initial instances for the specified project activity and geographic area. For example, the new project activity instances have financial, technical and/or other parameters (such as the size/scale of the instances) consistent with the initial instances, or face the same investment, technological and/or other barriers as the initial instances.	Each new Project Activity Instance must demonstrate additionality, as per methodology requirements and standard requirements.	VM0042 uses a project method for the demonstration of additionality, which include: As per methodology requirements, additionality is demonstrated using a project method, which includes: 1) A regulatory surplus demonstration as per VCS methodology requirements v4.1, 2) A barrier analysis to justify why adoption of the proposed project activities would not occur in the absence of the project 3) An adoption rate analysis to justify that the proposed project activities are not common practice
6	Where grouped projects include multiple baseline scenarios or demonstrations of additionality, such projects will require at least one set of eligibility criteria for each combination of baseline scenario and demonstration of additionality specified in the project description.	Each new Project Activity Instance must demonstrate which of the baseline scenarios listed in the methodology will be applicable.	At least one of the baseline scenarios must be utilized in the project activity instance, which must further demonstrate compliance with all the set of eligibility criteria for the inclusion of new project activities instances as outlined in this document.

The following table outlines the eligibility criteria for the inclusion of new project activity instances, as per clause 3.5.16 of the VCS Standard, Version 4.1

SL No.	Eligibility Criterion	Description / Required condition	Means of Verification / Supporting evidence for inclusion
1	Geographical boundaries: all new project activity instances must be located within the boundary of the grouped project	Each project activity instance included must be within the boundaries of the grouped project	Details of the croplands with geocoordinates and KML files will be part of the evidence
2	Comply with at least one complete set of eligibility criteria for the inclusion of new project activity instances. Partial compliance with multiple sets of eligibility criteria is insufficient.	New Project Activity Instances must comply with the full set of eligibility criteria for the inclusion of new project activity instances in this section.	New project instances shall provide all the relevant information with justifications in the relevant sections of the PDD.
3	Be included in the monitoring report with sufficient technical, financial, geographic, and other relevant information to demonstrate compliance with the applicable set of eligibility criteria and enable sampling by the validation / verification body (VVB).	Each new Project Activity Instances must have monitoring plans that define technical, financial, geographic, and other relevant information, which enable VVBs to do a third-party audit.	Section 5 and other relevant sections of the PD shall describe all relevant monitoring plans that define technical, financial, geographic, and other relevant information with respect to the project activity instance.
4	Be validated at the time of verification against the applicable set of eligibility criteria.	Each new project activity Instance must be validated at the time of verification against the applicable set of eligibility criteria as listed in this section	A new project activity must be explained with all relevant evidence in the relevant section of the PDD.

SL No.	Eligibility Criterion	Description / Required condition	Means of Verification / Supporting evidence for inclusion
5	Have evidence of project ownership, for each project activity instance, held by the project proponent from the respective start date of each project activity instance (i.e., the date upon which the project activity instance began reducing or removing GHG emissions).	New project activity instances must demonstrate ownership by the project participant, from the start date of the project activity instance.	Evidence may include, but is not limited to, the following documents: 1. Board resolution / Governing body decision / CEO / Director decision copy that has details on project requirements 2. Minutes of meetings or stakeholder consultations 3. Purchase details of equipment or materials required for project implementation. 4. Contracts with the farmers 5. Farmer Outreach events' recordings, pictures, invitations etc. 6. Periodic (quarterly, annual etc) published organizational reports of activities
6	Have a start date that is the same as or later than the grouped project start date	All the new project instances must provide evidence that the activities started after the group project start date.	Evidence may include, but is not limited to, the following documents: 1. Board resolution/ Governing body decision / CEO / Director decision copy which has details on the project requirement 2. Minutes of meetings or stakeholder consultations 3. Purchase details of equipment or materials required from project implementation

SL No.	Eligibility Criterion	Description / Required condition	Means of Verification / Supporting evidence for inclusion
			4. Farmer Outreach events' recordings, pictures, invitations etc. 5. Farmer activity attestations 6. Periodic (quarterly, annual etc) published organizational reports of activities
7	Be eligible for crediting from the start date of the instance through to the end of the project crediting period (only).	All the new Project Activity Instances must be eligible for crediting from the start date of the instance through to the end of the project crediting period (only).	Each Instance should provide the details to meet this criterion.
8	Where inclusion of a new project activity instance necessitates the addition of a new project proponent to the project, such instances shall be included in the grouped project within two years of the project activity instance start date	The addition of a new project proponent to Project Activity Instances shall be included in the grouped project within two years of the project activity instance start date.	Boomitra will be the project proponent of this project. However, this project may have multiple implementation partners. Contract documents, MoU documents or board meeting documents will be evidence.

1.5 Project Proponent

Organization name	ConserWater Technologies Inc
Contact person	Chethan T. R.
Title	Carbon Projects Development Lead

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1.6 Other Entities Involved in the Project

Left blank intentionally as per Section 3.1.3 of the VCS Procedural Document; Registration and Issuance Process: (Version 4.1)

1.7 Ownership

Land Ownership

In India, the vast majority of agricultural lands are directly owned by individual farmers. These farmers have well-defined land records that are registered with their respective state governments and can be verified with their state government land record databases.

Furthermore, agriculture is considered a state subject in India. As a result, laws of tenancy of agricultural land vary across different states. A few states prohibit the leasing of lands directly, while other states control leasing indirectly through various legal riders. Similarly, different states have different ceilings on the amount of land that may be leased by a given entity or individual[5].

Credit Ownership

The individuals or entities enrolling their lands irrevocably assign the right, title and interest to the Greenhouse Gas Reductions and Removals (Carbon credits) generated on their lands during the project to ConserWater Technologies Inc (doing business as Boomitra). This is covered by legal agreements with the individuals and/or entities enrolling their lands.

The individuals and/or entities who are legally authorized to sign these agreements are those who own the carbon rights currently and for the foreseeable future extending to the longevity of the project. For example, if the owner of a farm is also the farmer operating the farm, this farmer is authorized to sign the agreement. On the other hand, when the owner leases the farm to a different farmer to operate it, the structure of the leasing contract determines credit ownership. If the leasing contract makes an explicit indication of the rights to the carbon credits being transferred along with the lease to the farmer operating the farm for at least the total duration of the longevity of the project, then the lessee farmer may sign the agreement with Boomitra. Otherwise, the owner must sign the agreement with Boomitra.

[5] NITI AAYOG. 2016. *REPORT OF THE EXPERT COMMITTEE ON LAND LEASING*. [online] Available at: <https://www.niti.gov.in/writereaddata/files/document_publication/Final_Report_Expert_Group_on_Land_Leasing.pdf > [Accessed 20 January 2022].

1.8 Project Start Date

Project Start Date: September 1, 2017

The project start date is September 1, 2017, the approximate time of adoption of the project activities by the first farmers participating in the program, under the educational guidance of ground staff. This start date is substantiated by activity records and farmer engagement records from the ground staff dating from the start date. It is also substantiated by signed attestations by the farmers of their previous practices and transitions to new practices and/or expanded practices.

1.9 Project Crediting Period

The duration of the VCS project crediting period is initially 20 years with a possibility for renewal four times. The present project crediting period starts on September 1, 2017 and ends on August 31, 2037.

1.10 Project Scale and Estimated GHG Emission Reductions or Removals

The estimated annual GHG emission reductions/removals of the project are:

☐ <20,000 tCO_2e/year

☐ 20,000 – 100,000 tCO_2e/year

☒ 100,001 – 1,000,000 tCO_2e/year

☐ >1,000,000 tCO_2e/year

1.11 Description of the Project Activity

A non-exhaustive list of project activities is given below:

1. Reduce tillage/improve residue management
    a. Reduced tillage/ Conservation tillage
    b. No till
    c. Crop residue retention and reincorporation
2. Reduced fertilizer application
    a. Optimized fertilizer application
    b. Organic fertilizer application (e.g., manure, compost)
    c. Urease inhibitor application (e.g. NBPT, or controlled release fertilizer)
    d. Adoption of specialized fertilizers
3. Adoption of soil probiotics or other amendments
4. Improved water management/irrigation
    a. No irrigation/precision irrigation
    b. Alternative wetting and drying (AWD)
5. Improve crop planting and harvesting
    a. Rotational commercial crop
    b. Continuous commercial crop with cover crop

c. Rotational commercial crop with cover crop
d. Double cropping
e. Relay cropping
f. Intercropping of cover crop with commercial crop (e.g. improved agroforestry) during the same growing season

The project activities are various forms of improved agriculture practices that are newly adopted or expanded by farmers to increase Soil Organic Matter (SOM) and sequester CO_2. Since each farmer is an independent actor, the exact package of practices adopted varies from farmer to farmer. Furthermore, the extent to which each farmer successfully implements a suite of practices varies based on the farmer's behaviors, pre-existing soil conditions, hyperlocal weather factors and other local variables.

SOM includes all organic substances within the soil. It stores nutrients in the soil and acts as a direct source of nutrients for crops. Some of the world's most fertile soils tend to contain high amounts of organic matter. Organic matter is a key component of soil that affects its physical, chemical, and biological properties – the higher the concentration of SOM, the better the quality of the soil. It reduces soil erosion and improves soil structure while increasing water retention capabilities. Soil Organic Carbon (SOC) specifically denotes the carbon content of SOM.

Biomass that decomposes over time inside the soil forms humus[6]. Humus is a significant component of SOM, representing all of the organic matter that is amorphous in nature[7]. Furthermore, humus is an integral component of organic matter because it is fairly stable and resistant to further decomposition. Humus is brown or black and gives healthy soils their dark color (See Figure 1). Humus is a key component of the soil microbiome and enhances soil microbial activity when present – good levels of microbial activity are central to improving soil health[8]. The anticipated changes in soil humus content with the institution of project activities are shown in Figure 2.

[6] Bot, A. and Benites, J., 2005. *The importance of soil organic matter: Key to drought-resistant soil and sustained food production*. Rome: Food and Agricultural Organization.
[7] Encyclopedia.com. 2018. *Humus*. [online] Available at: <https://www.encyclopedia.com/plants-and-animals/agriculture-and-horticulture/agriculture-general/humus> [Accessed 20 January 2022].
[8] Sparks, D., 2017. *Environmental Soil Chemistry*. Saint Louis: Elsevier Science & Technology, pp.75-113.

Figure 1: Humus-Rich Soil[9]

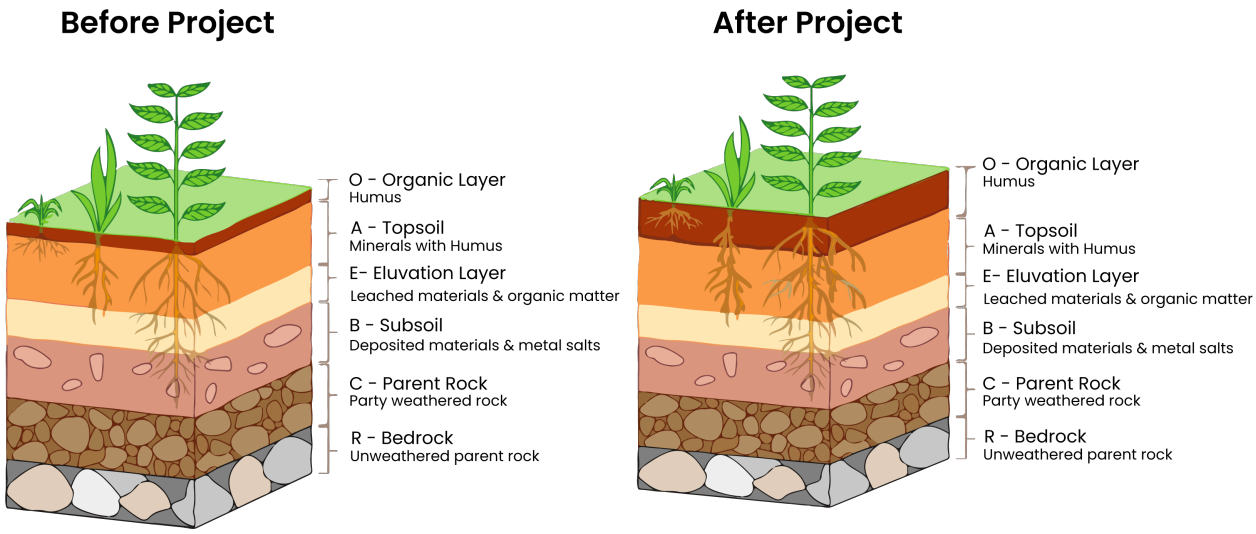


Figure 2: Comparison of baseline and project scenario on soil structure, with increased SOC in the project scenario

In the following paragraphs, different practices than enhance SOM and SOC are outlined in further detail.

1. **Reduce tillage/improve residue management**

Certain crops produce extensive residues that may be thrown away or otherwise not put to good use. When reincorporated into the soil, they lead to an increase in SOC.

i. **Stopping crop residue burning:** Several farmers have historically burned their excess crop residue, because it is the simplest way to handle excess biomass and prepare the land for next crop. Several farmers in this project now stop burning, which itself leads to soil carbon increases as loss from the soil is decreased. The crop residue may be collected and used as compost/mulch to increase soil carbon. Alternatively, mechanized tools such as Happy Seeders and Super Seeders can be used to plant the next crop directly in the residues of the previous crop. The Happy Seeder is a no-till planter, allowing the new crop to be sown into soil through the shredded residues of the previous crop. The Super Seeder plows back crop residues while seeding the new crop. Researchers have found that these forms of straw incorporation into the soil increase soil fertility and boost carbon sequestration[10,11,12]. The majority of the farmers in the project area

[9] Phys.org. 2016. *Significant humus loss in forests of the Bavarian Alps*. [online] Available at: <https://phys.org/news/2016-06-significant-humus-loss-forests-bavarian.html> [Accessed 20 January 2022].
[10] Sharma Sandeep, Singh Pritpal, Kumar Sandeep, TITLE=Responses of Soil Carbon Pools, Enzymatic Activity, and Crop Yields to Nitrogen and Straw Incorporation in a Rice-Wheat Cropping System in North-Western India, JOURNAL=Frontiers in Sustainable Food Systems, VOLUME=4, YEAR=2020,<https://www.frontiersin.org/article/10.3389/fsufs.2020.532704>
[11] Chivenge P. et al. (2020) Rice Straw Incorporation Influences Nutrient Cycling and Soil Organic Matter. In: Gummert M., Hung N., Chivenge P., Douthwaite B. (eds) Sustainable Rice Straw Management. Springer, Cham.
[12] Zhao, X., Yuan, G., Wang, H., Lu, D., Chen, X., Zhou, J., 2019. Effects of Full Straw Incorporation on Soil Fertility and Crop Yield in Rice-Wheat Rotation for Silty Clay Loamy Cropland. Agronomy 9, 133.

have been historically burning crop residues on their lands and only very small amounts of straw have been incorporated into the soil in baseline scenario (14% of rice and 9% of wheat[13]).

In the case where the residues are thrown into large pits, decomposition of residues in the pit can create an anaerobic environment that leads to GHG emissions. Similarly, when the cattle eat residues and produce manure, the manure produced by the cattle may often be thrown into the same pits, again producing harmful emissions[14]. Instead of directly or indirectly throwing residues into pits and allowing them to decompose in-place, farmers can use them as a mulching agent in their lands. Researchers have found that this incorporation of residues into the soil increases soil fertility and boosts carbon sequestration[15] in the soil[16].

More generally, various studies worldwide have suggested that no till or reduced till can also play a vital role in increasing SOC[17]. There are many co-benefits to this practice, including improved soil nutrient cycling, reduced soil erosion, improved water infiltration and reduced evaporation[18]. Researchers have demonstrated that no-till enhances macroaggregate stability and microaggregate formation, which lead to greater protection of SOC from microbial decomposition[19,20].

ii. Happy Seeder

The Happy Seeder is a tractor-mounted machine that cuts and lifts rice straw, sows wheat into the soil, and deposits the straw over the sown area as mulch. Happy Seeder allows the seed to be sown directly into combine-harvested rice stubble, as a no-till planter. Several studies have indicated that the Happy seeder is one of the key game changers in containing stubble burning and has the capacity to be implemented at scale across the project region[21].

[13] Abdurrahman, M., Chaki, S. and Saini, G., 2020. Stubble burning: Effects on health & environment, regulations and management practices. *Environmental Advances*, 2, p.100011.
[14] Jun, P., Gibbs, M. and Gaffney, K., n.d. *CH4 AND N2O EMISSIONS FROM LIVESTOCK MANURE*. [online] Intergovernmental Panel on Climate Change. Available at: <https://www.ipcc-nggip.iges.or.jp/public/gp/bgp/4_2_CH4_and_N2O_Livestock_Manure.pdf> [Accessed 20 January 2022].
[15] Wang X, He C, Liu B, Zhao X, Liu Y, Wang Q, Zhang H. Effects of Residue Returning on Soil Organic Carbon Storage and Sequestration Rate in China's Croplands: A Meta-Analysis. *Agronomy*. 2020; 10(5):691.
[16] Erenstein, O., 2002. Crop residue mulching in tropical and semi-tropical countries: An evaluation of residue availability and other technological implications. *Soil and Tillage Research*, 67(2), pp.115-133.
[17] SPARGO, J., ALLEY, M., FOLLETT, R. and WALLACE, J., 2008. Soil carbon sequestration with continuous no-till management of grain cropping systems in the Virginia coastal plain. *Soil and Tillage Research*, 100(1-2), pp.133-140.
[18] Paustian, K. et al. Agricultural soils as a sink to mitigate CO2 emissions. Soil Use and Management 13, 230–244 (1997)
[19] Six, J., Elliott, E. T. & Paustian, K. Soil macroaggregate turnover and microaggregate formation: A mechanism for C sequestration under no-tillage agriculture. Soil Biology and Biochemistry 32, 2099–2103 (2000).
[20] Kahlon, M.S.; Lal, R.; Ann-Varughese, M. Twenty two years of tillage and mulching impacts on soil physical characteristics and carbon sequestration in Central Ohio. Soil Tillage Res. 2013, 126, 151–158.
[21] Shyamsundar, P., Springer, N., Tallis, H., Polasky, S., Jat, M., Sidhu, H., Krishnapriya, P., Skiba, N., Ginn, W., Ahuja, V., Cummins, J., Datta, I., Dholakia, H., Dixon, J., Gerard, B., Gupta, R., Hellmann, J., Jadhav, A., Jat, H., Keil, A., Ladha, J., Lopez-Ridaura, S., Nandrajog, S., Paul, S., Ritter, A., Sharma, P., Singh, R., Singh, D. and Somanathan, R., 2019. Fields on fire: Alternatives to crop residue burning in India. *Science*, 365(6453), pp.536-538.

Figure 3: DASMESH Happy Seeder[22]

The above Figure 3 represents a typical Happy Seeder.

Figure 4: Farmers with Happy Seeder

In the project area, harvester combines are used for harvesting in 80-90% of the area. This method leaves huge quantities of crop residue in the field. It is estimated that 8 to 70 tons of residue per hectare is left behind after harvesting. With the use of the Happy seeder, all of this crop residue is shredded, and the new crop is directly seeded through the residue. According to a study conducted by the Borlaug Institute for South Asia, this project activity will have a positive impact on yields[23]. The average yield of wheat increases by 2-4% compared to conventional methods. In addition, there are reduced costs of production and increased nutrient content in

[22] Dasmesh. n.d. *Happy Seeder*. [online] Available at: <https://www.dasmesh.com/dasmesh_happy_seeder.html#I> [Accessed 3 February 2022].
[23] Alwin Keil, P. P. Krishnapriya, Archisman Mitra, Mangi L. Jat, Harminder S. Sidhu, Vijesh V. Krishna & Priya Shyamsundar (2021) Changing agricultural stubble burning practices in the Indo-Gangetic plains: is the Happy Seeder a profitable alternative?, International Journal of Agricultural Sustainability, 19:2, 128-151

the soil from using a Happy Seeder. Indirectly, this method saves nearly 1 million liters per hectare due to the elimination of pre-sowing irrigation.

iii. Ratoon Manager

The Ratoon Manager is another residue management machine, which is primarily used in sugarcane residue management. Like the Happy Seeder, this implement also helps in cutting crop residue near the ground, thereby resulting in a uniform growth of sugarcane crop. This tractor implement has multiple uses. This machine takes care of crop residue shaving or cutting, barring or dismantling of ridges, interculture operation and fertilizer application[24].

Figure 5: Ratoon Manager[25]

[24] Ali, Javed. (2015). Mechanization of Sugarcane Cultivation. 10.13140/RG.2.1.4056.9049
[25] John Deere. n.d. *Tractor Implements | Green System Ratoon Manager*. [online] Available at: <https://www.deere.co.in/en/implements/ratoon-manager/> [Accessed 3 February 2022].

Figure 6: Ratoon Manager from another manufacturer

2. Reduced fertilizer application

Though the addition of synthetic fertilizer can increase crop yields, their over-utilization has led to decreased soil fertility, polluted ecosystems and GHG emissions[26]. Excessive synthetic fertilizers can often cause changes to the natural equilibrium of the soil microbiome, moving it in the direction of favoring SOM decomposition[27]. Hence, soil degradation can happen very quickly. Once substantial amounts of SOM are lost, crops can become dependent on synthetic fertilizers, leading to further deterioration of soils[28]. Furthermore, overuse of synthetic nitrogen fertilizer is leading to emissions of N_2O – which is the most significant net greenhouse gas emitted by the agricultural sector worldwide[29]. Therefore, farmers can realize significant benefits from adopting balanced fertilized management practices such as using organic fertilizers and farmyard manure/compost, reducing synthetic fertilizer usage, and adopting specialized fertilizers to increase the soil fertility and eventually buildup of SOC[30]. Farmers will be given training programs to adopt balanced fertilizer management practices in their lands.

[26] US Environmental Protection Agency. n.d. *The Sources and Solutions: Agriculture*. [online] Available at: <https://www.epa.gov/nutrientpollution/sources-and-solutions-agriculture> [Accessed 20 January 2022].
[27] Khan, S., Mulvaney, R., Ellsworth, T. and Boast, C., 2007. The Myth of Nitrogen Fertilization for Soil Carbon Sequestration. *Journal of Environmental Quality*, 36(6), pp.1821-1832.
[28] Pahalvi, Heena & Rafiya, Lone & Rashid, Sumaira & Nisar, Bisma & Kamili, Azra. (2021). Chemical Fertilizers and Their Impact on Soil Health. 10.1007/978-3-030-61010-4_1.
[29] Singh, S., Singh, P., Srivastava, K. and Rangabhashiyam, S., 2021. *Global climate change*. Amsterdam: Elsevier, pp.151-174.
[30] Nayak, A., Shahid, M., Shukla, A., Kumar, A., Raja, R., Tripathi, R. and Panda, B., 2022. *Soil organic carbon sequestration in agriculture: Issues and priorities*. [online] Indian Council of Agricultural Research. Available at: <https://krishi.icar.gov.in/jspui/bitstream/123456789/37844/1/Soil%20organic%20carbon%20sequestration%20in%20agriculture%20Issues%20and%20priorities.pdf> [Accessed 20 January 2022].

i. **Urease Inhibitors:** These allow for slow release of fertilizer, resulting in reduced N2O emissions and reduced cumulative fertilizer use. These inhibitors also have the potential to improve soil carbon by reducing bacterial decomposition processes for soil carbon.

ii. **Precision fertilizer application**: Farmers who have previously use an excess amount of fertilizer can apply fertilizer more precisely when it is needed by the plant and thus reduce N2O emissions, while potentially allowing soil carbon to increase more efficiently (incorrect amounts of fertilizer could lead to either a lack of sufficient nutrient for biomass creation, or conversely, cause soil bacteria hyperactivity, which can lead to soil carbon loss through bacterial decomposition).

iii. Vermicomposting

This project promotes vermicomposting, which uses certain earthworms to boost the process of organic conversion to produce good quality compost. Vermicompost can be made by using a variety of organic wastes, such as agriculture and household wastes. Vermicompost is odorless, clean, and contains significant amounts of N, P, K and other micronutrients essential for plant growth. It is eco-friendly, non-toxic, consumes low energy inputs for composting and is a recycled biological product.

3. Adoption of soil probiotics and other amendments

Soil probiotics and amendments are products that are known to improve soil fertility and increase SOC. Adoption of amendments such as manure, compost, SOC-forming microbes and humic acids will also lead to improvements in the overall biological properties of soils[31].

4. Improved water management/irrigation

Water management plays an important role in improved agriculture. Water use efficiency is one of the key water management activities planned under this project. At present, there are several barriers to the adoption of water use efficiency, including a lack of finance, knowledge, and technology access. Improvements can be made through better irrigation practices, which decrease water loss through evaporation, and through improved water storage techniques[32]. One example of a practice for improving water use efficiency is drip irrigation, which uses pipes with perforations to directly deliver water and nutrients to crop root zones, allowing for precision application and reduced water and fertilizer wastage. Targeted application at the root zone directly leads to improved root development, resulting in better biomass generation and higher SOC sequestration. Furthermore, utilizing drip irrigation as opposed to the more common flood or furrow irrigation leads to reduced topsoil erosion, which is considered a key mechanism through which SOC could be lost[33]. Another highly promising practice is precision irrigation scheduling, wherein the water applied to the farm is scaled by the plant's or soil's actual needs. This

[31] Martinez-Blanco, J., Lazcano, C., Christensen, T.H., Munoz, P., Rieradevall, J., Møller, J., & Boldrin, A. (2013). Compost benefits for agriculture evaluated by life cycle assessment. A review. Agronomy for sustainable development, 33(4), 721-732.
[32] IAEA. 2022. *Agricultural water management*. [online] Available at: <https://www.iaea.org/topics/agricultural-water-management> [Accessed 20 January 2022].
[33] Bjorneberg, D., n.d. *Irrigation: Erosion*. [online] US Department of Agriculture. Available at: <https://eprints.nwisrl.ars.usda.gov/id/eprint/1572/1/1528.pdf> [Accessed 20 January 2022].

practice, again, leads to better biomass generation by maintaining an ideal soil moisture content and reduced erosion by minimizing the frequency of irrigation events.

Alternative wetting and drying (AWD) is one of the improved water management techniques that may be followed in paddy cultivation to reduce water usage. This method normally has an efficiency of 30% (reduction in water usage[34]) and farmers can save money on irrigation practices. Another major advantage of this method is reductions in GHG emissions, such as methane from cropping fields. This method improves nitrogen usage and other organic inputs. Flooded rice fields emit a significant amount of methane and AWD is widely accepted as one of the most credible practices to reduce water usage and abate these emissions. Several studies[35] suggest that a 14% to 80% methane emission reduction can be achieved through multiple drying.

5. Improve crop planting and harvesting

Monoculture systems around the world have made soils less fertile over the last several decades and crops more susceptible to pests and diseases. This has increased the need for external crop inputs and crop protection products to be used in excess.

In contrast to monoculture, employing a crop rotation increases soil organic matter and overall soil properties. This method helps to improve the sustainability of croplands and eventually increase SOC[36]. It involves the promotion of alternative cropping systems with different timelines. For example, a given farm may choose to not grow the same type of crop in consecutive years, and the farm may instead rotate high residue crops with low residue crops, or an N-consuming crop with an N-fixing crop. These practices reduce soil erosion, improve soil nutrient balances, and increase SOC.

A farm may also incorporate additional crops as cover crops or intercropping directly with the main crop. Greater combined crop yield per unit of land and reduced yield variability are some of the benefits of a cover cropping system[37]. This activity protects soil that would otherwise be exposed to the elements, while also building biomass, and eventually increasing SOC[38]. This practice also helps in decreasing soil compaction, managing soil moisture, and sometimes providing additional forage for livestock. The choice of cover crop depends on existing conditions and future crops planned on a particular farm.

All the above-mentioned project activities have a significant impact on soil health. Each farmer may adopt one or more activities listed above in this project. Interventions such as capacity building programs, mass

[34] Richards, M. and Sander, B., 2014. *Alternate wetting and drying in irrigated rice*. [online] CGIAR. Available at: <http://www.agritech.tnau.ac.in/agriculture/pdf/csa_pdf/Alternate_wetting_and_drying_in_irrigated_rice_InfoNote.pdf > [Accessed 20 January 2022].
[35] Amnat Chidthaisong, Nittaya Cha-un, Benjamas Rossopa, Chitnucha Buddaboon, Choosak Kunuthai, Patikorn Sriphirom, Sirintornthep Towprayoon, Takeshi Tokida, Agnes T. Padre & Kazunori Minamikawa (2018) Evaluating the effects of alternate wetting and drying (AWD) on methane and nitrous oxide emissions from a paddy field in Thailand, Soil Science and Plant Nutrition, 64:1, 31-38
[36] United States Department of Agriculture. 1996. *Conservation Crop Rotation Effects on Soil Quality*. [online] Available at: <https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_053269.pdf> [Accessed 20 January 2022].
[37] Chahal, I., Vyn, R.J., Mayers, D. *et al.* Cumulative impact of cover crops on soil carbon sequestration and profitability in a temperate humid climate. *Sci Rep* **10,** 13381 (2020).
[38] Kaspar, T. C. and Singer, J. W., "The Use of Cover Crops to Manage Soil" (2011). Publications from USDAARS / UNL Faculty. 1382. https://digitalcommons.unl.edu/usdaarsfacpub/1382

awareness programs and training are provided and are planned in the future implementation of the project.

This is not an exhaustive list of practices, and further practices may be added in the future during verification events as appropriate. Full descriptions and additionality assessments of any new practices will be available during verification whenever they are added. Ground staff assist in advising farmers on the right practices for them to adopt, and help surmount any educational barriers they may face in the process.

To achieve project objectives, Boomitra is in the process of devising a comprehensive set of software and data tools. Through these tools, enrolled farmers submit their farming activity data through applications accessible on smartphones. Once received, Boomitra will analyze the data submitted by farmers and use it to quantify carbon sequestered in the project activity by using an approved and registered monitoring plan to measure SOC changes on the farm.

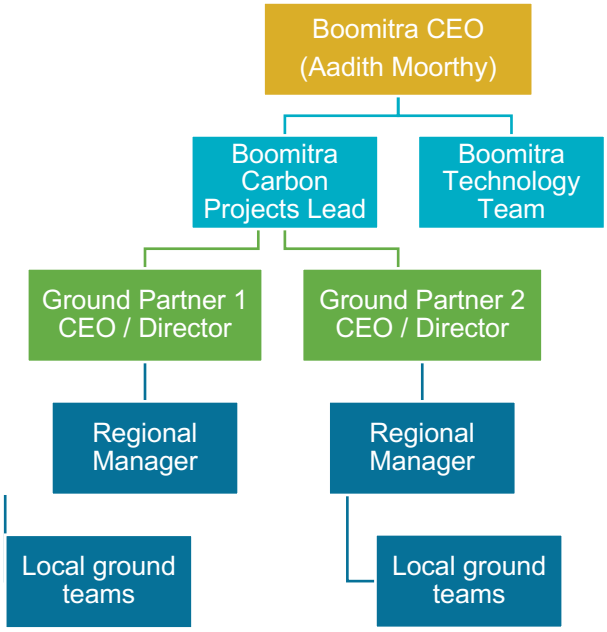
Project Implementation process

Boomitra will implement the project activities alongside ground implementation partners. As a part of the project implementation schedule, field procedures will be developed and will be made available during verification. With the help of ground implementation staff, project managers will monitor all activities to make sure data is captured correctly and appropriately fed to the database. Regular trainings, awareness creation activities and follow-up programs are necessary to improve agricultural practices and bring about behavior change among the farmers.

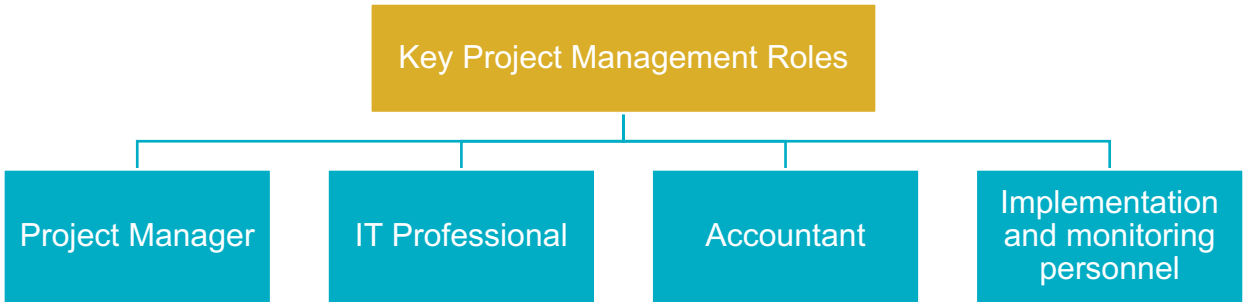
Detailed information on management and other aspects of the project implementation will be provided during validation.

1.11.1 Project organizational setup

The project will operate under the guidance of the Boomitra carbon projects team and technology team, along with our partners. All technical support will be provided by Boomitra, and ground-level project activities will be executed by our partners in conjunction with Boomitra. Agreements have been made between Boomitra and local partners, clearly explaining the roles and responsibilities of both parties. The following organizational setup has been planned for this project's implementation and monitoring.



Our local ground partners have been working with farmers for many years to promote improved agriculture practices and to improve soil carbon levels. Boomitra has developed the key technology components required for the project, including the measurement of soil carbon to 30 cm depth and the tools and interfaces for farmer enrollment, implementation, and MRV activities.



1.11.2 Jurisdictional REDD+ Programs

This project activity and location are not covered by any jurisdictional REDD+ program.

1.12 Project Location

This is a grouped project encompassing the Republic of India.

Country: Republic of India

Grouped Project States: Arunachal Pradesh, Assam, Bihar, Haryana, Himachal Pradesh, Jammu & Kashmir, Jharkhand, Madhya Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Punjab, Rajasthan, Sikkim, Tripura, Uttar Pradesh, Uttarakhand, and West Bengal are the states included in the grouped project. Separate tables listing states included in each instance will be provided.

Figure 7: Political Map of India[39]

A GeoJSON with a more detailed set of coordinates is available separately for validation and verification.

1.13 Conditions Prior to Project Initiation

This project consists of croplands. Conditions outlined in this section involve environmental conditions of the areas included in the grouped project, including information on the climatic, edaphic, and other relevant conditions related to the project.

- **Ecosystem type:**

[39] Maps of India. 2020. *India Map*. [online] Available at: <https://www.mapsofindia.com/images2/india-map.jpg> [Accessed 20 January 2022].

Most of the croplands under this grouped project are under the semi-arid, sub-humid, humid and perhumid ecosystem regions of India[40].

All the states included in this grouped project (see section 1.12 of this document) fall under the Northern plains, which are formed by three major river systems, the Ganga, the Brahmaputra and the Indus rivers. These plains have rich alluvial soils that are brought by these river systems from the Himalayan mountains. The croplands in Punjab and parts of Jammu & Kashmir are formed by the Indus and its tributaries whereas they are formed by the Brahmaputra and its tributaries in the North-East states and the Ganga and its tributaries in the other states[41].

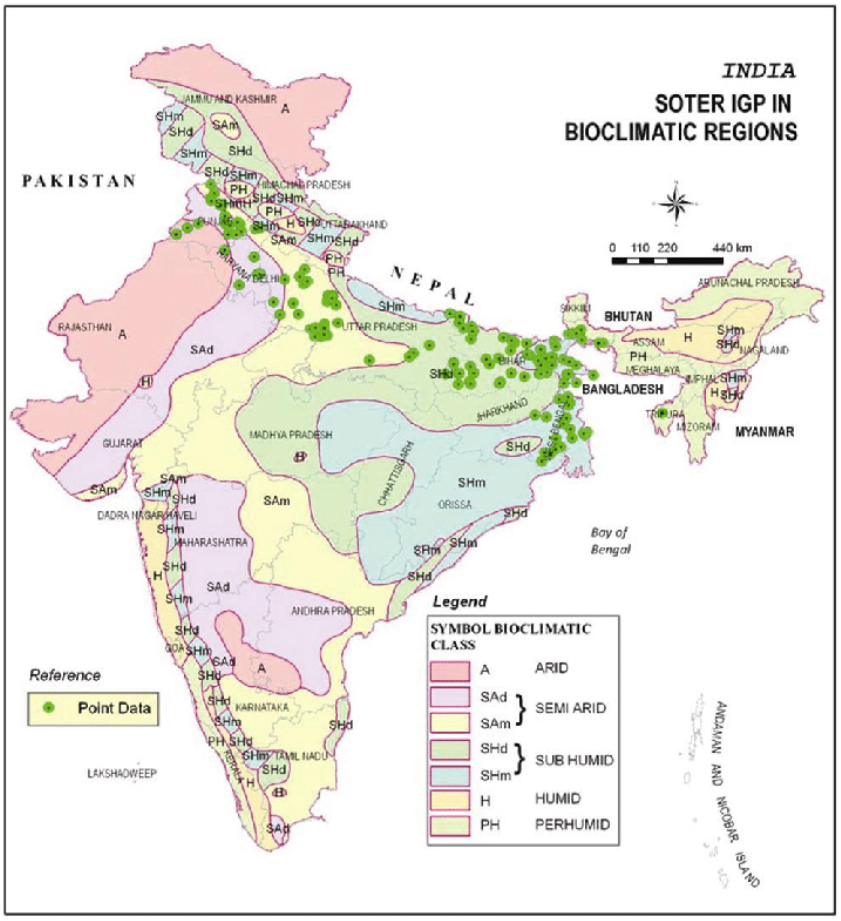


Figure 8: Bioclimatic class map of the Indo-Gangetic Plains developed for SOTER IGP[42].

[40] Singh, J. and Chaturvedi, R., 2017. Diversity of Ecosystem Types in India: A Review. *Proceedings of the Indian National Science Academy*, 92(0).
[41] PMF IAS. *Indo-Gangetic-Brahmaputra Plain | Bhabar, Terai, Bhangar, Khadar.* [online] Available at: <https://www.pmfias.com/indo-gangetic-brahmaputra-plain-bhabar-terai-bhangar-khadar-reh-kollar/> [Accessed 3 February 2022].
[42] Chandran, P. & Tiwary, Pramod & Bhattacharyya, Tapas & Mandal, Champa & Prasad, Janaka & Ray, S. & Sarkar, Dhanjit & Pal, Dilip & Mandal, Deepak & Sidhu, Sidhu & Nair, K & Sahoo, Anil & Das, T & Singh, Singhsar & Srivastava, Rajeev & Sen, Tarun & Chatterji, Shubhankar & Patil, Nitin & Reddy, G.P. Obi & Thakre, Shashwat. (2014). Development of soil and terrain digital database for major food-growing regions of India for resource planning. Current science. 107. 1420-.

- **Current and historical land-use:**

The region is mostly treeless naturally and used to be a large-scale fertile grassland prior to human occupation[43]. The Indo-Gangetic region has been intensively inhabited for the past millennia, and satellite images also confirm the continuous presence of farms at least over the last several decades. Cropland area in Indo-Gangetic plains has increased during the period 1901-1990[44]. Today, the region is agricultural, without many remnants of the native vegetation or ecosystems.

- **Has the land been cleared of native ecosystems within 10 years of the project start date?**

☐ Yes ☒ No

1.14 Compliance with Laws, Statutes and Other Regulatory Frameworks

The project activity follows all the applicable legal and regulatory requirements. Currently no laws or regulations prevent or enforce the project activity or baseline land use scenarios. Government programs generally promoting various subsets of project activities may exist, but there are no regulations mandating the adoption or avoidance of any project activities in an enforceable manner.

The relevant statutes concerning labor rights are the Code on Wages, 2019; the Industrial Relations Code, 2020; the Occupational Safety, Health and Working Conditions Code, 2020; and the Code on Social Security, 2020[45]. The wages, benefits and other rights given to workers by these statutes are followed by Boomitra and all ground partners working on this project with their own employees and are extended to all employed staff.

Some other laws and frameworks of relevance include:

1. **The Wildlife (Protection) Act, 1972 (Amended 1991):** The proposed project does not involve any activities that have an impact on wildlife. Hence, this is not applicable. However, the project complies with this Act's rules and guidelines.

2. **The Forest (Conservation) Act, 1980 (Amended 1988):** The proposed project is on agricultural lands and activities do not involve the conversion of forest land to other land uses. Hence this law is not applicable. However, the project complies with the Act's rules and guidelines.

3. **Environment (Protection) Act, 1986 (EPA):** The act protects and improves environment conditions by setting standards and regulating emissions, discharges, management of hazardous waste, public health, and welfare protection. The project complies with the

[43] Hanqin Tian, Kamaljit Banger, Tao Bo, Vinay K. Dadhwal,: History of land use in India during 1880–2010: Large-scale land transformations reconstructed from satellite data and historical archives, Global and Planetary Change, Volume 121, 2014, Pages 78-88, ISSN 0921-8181

[44] V.K. Dadhwal, A. Chhabra Landuse/landcover change in Indo-Gangetic plains: cropping pattern and agroecosystem carbon cycle Y.P. Abrol, S. Sangwan, M.K. Tiwari (Eds.), Landuse Change Historical Perspectives: Focus on Indo-Gangetic Plains, Allied Publishers Pvt. Ltd (2002), pp. 249-276

[45] Ramanan, K. and Narang, N., 2021. *Employment & Labour Laws and Regulations | India*. [online] Global Legal Insights. Available at: <https://www.globallegalinsights.com/practice-areas/employment-and-labour-laws-and-regulations/india> [Accessed 20 January 2022].

requirements of the Act and promotes sustainable use and management of natural resources and croplands.

4. **Human rights:** The project does not involve any conflict with the livelihoods of local people and respects all human rights. Stakeholder consultations have been carried out to get their opinions. This project is not complicit in violence or human rights abuses of any kind as defined in the Universal Declaration of Human Rights and Protection of Human Rights act[46], 1993. The project adheres to India's commitment to: Universal Declaration of Human Rights (UDHR), International Covenant on Economic, Social and Cultural Rights (India Accession 10/04/79[47]), International Covenant on Civil and Political Rights (India Accession 10/04/79[48]).

5. India ratified the International Convention on the Elimination of All Forms of Racial Discrimination with certain reservation[49]. The project activity is in line with strategy of elimination of discrimination.

6. The project does not indulge, promote or reinforce any kind of corruption. Any corrupt activity is an illegal activity in the host country and the project abides by the United Nations Convention Against Corruption. India ratified[50] this convention on 09/05/11.

7. India has laws in place prohibiting forced and compulsory labor and has a strict prohibition of child labor[51]. The project does not promote any form of child labor.

8. The project does not have any kind of impact on natural water patterns / flows.

Agriculture is a state subject in India. All project instances added under this grouped project will adhere to the local laws governing agriculture in that region.

[46] 1993. THE PROTECTION OF HUMAN RIGHTS ACT, 1993. [ebook] Available at: <https://www.indiacode.nic.in/bitstream/123456789/15709/1/A1994____10.pdf> [Accessed 3 February 2022].
[47] United Nations Human Rights Treaty Bodies. n.d. *Ratification Status for India*. [online] Available at: <https://tbinternet.ohchr.org/_layouts/TreatyBodyExternal/Treaty.aspx?CountryID=79&Lang=EN> [Accessed 20 January 2022].
[48] University of Minnesota Human Rights Library. n.d. *Ratification of International Human Rights Treaties - India*. [online] Available at: <http://hrlibrary.umn.edu/research/ratification-india.html> [Accessed 20 January 2022].
[49] United Nations Treaty Collection. 1969. *International Convention on the Elimination of All Forms of Racial Discrimination*. [online] Available at: <https://treaties.un.org/Pages/ViewDetails.aspx?src=IND&mtdsg_no=IV2&chapter=4&clang=_en#EndDec> [Accessed 20 January 2022].
[50] United Nations : Office on Drugs and Crime. 2021. *Signature and Ratification status*. [online] Available at: <http://www.unodc.org/unodc/en/corruption/ratification-status.html> [Accessed 20 January 2022].
[51] Press Information Bureau, Government of India. 2017. *Ratification of core ILO Conventions No. on 138 and 182 on Child Labour*. [online] Available at: <https://pib.gov.in/newsite/PrintRelease.aspx?relid=165604> [Accessed 20 January 2022].

As per India's Intended Nationally Determined Contribution (NDC) commitments[52], agriculture is one of the sectors where the Government has planned adaptation programs to combat climate change. Programs like the National Initiative on Climate Resilient Agriculture (NICRA) and the National Mission on Sustainable Agriculture (NMSA) are promoting sustainable agriculture practices. But the outreach of these programs is extremely limited when compared to the total number of farmers in India. To realistically achieve NDC targets, farmers must join hands with both government programs and policies, and non-governmental for-profits and non-profits. Hence, in the current regulatory scenario, this proposed voluntary project will have a clear impact on both farmers and the climate.

1.15 Participation under Other GHG Programs

1.15.1 Projects Registered (or seeking registration) under Other GHG Program(s)

This is a grouped project. This grouped project is neither registered in any other GHG program nor going to register or participate in any other GHG Programs other than VCS. All new project instances to be added to this grouped project are required to demonstrate whether the project was part of any other GHG program.

1.15.2 Projects Rejected by Other GHG Programs

The project has not been submitted to any other GHG Programs and has not been rejected by any other GHG programs.

1.16 Other Forms of Credit

1.16.1 Emissions Trading Programs and Other Binding Limits

Does the project reduce GHG emissions from activities that are included in an emissions trading program or any other mechanism that includes GHG allowance trading?

☐ Yes ☒ No

If yes, provide the name of the emissions trading program or other mechanism that allows GHG allowance trading.

The project neither has nor intends to generate any other form of GHG-related environmental credit for GHG emission reductions or removals claimed under the VCS Program

1.16.2 Other Forms of Environmental Credit

[52] UNFCCC. n.d. *INDIA'S INTENDED NATIONALLY DETERMINED CONTRIBUTION: WORKING TOWARDS CLIMATE JUSTICE*. [online] Available at: <https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/India%20First/INDIA%20INDC%20TO%20UNFCCC.pdf> [Accessed 20 January 2022].

Has the project sought or received another form of GHG-related credit, including renewable energy certificates?

☐ Yes ☒ No

If yes, provide the name of the other program(s) under which the project has sought or received another form of GHG-related credit.

This project neither has nor intends to seek or receive another form of GHG related environmental credit including renewable energy certificates or any other environmental credits.

1.17 Sustainable Development Contributions

The grouped project contributes to the following SDGs. The below table explains the parameter selected from each of the goals and the project's impact on that particular goal.

SDG Goal	Chosen Parameter	Project Impact
	End Poverty: 1.4 By 2030, ensure that all men and women, the poor and the vulnerable, have equal rights to economic resources, as well as access to basic services, ownership and control over land and other forms of property, inheritance, natural resources, appropriate new technology and financial services, including microfinance. And 1.5 By 2030, build the resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters	Farmers can adopt new innovative technologies and practices (partially funded by Carbon Finance) to combat climate change. Improved agriculture practices enable farmers to reduce their direct and indirect costs involved in farming activities. There will an upfront cost to adopt the technologies and practices, but through carbon finance farmers will benefit over and beyond the project cycle.
	2.4 By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather,	The project activity improves the quality of soils by increasing Soil Organic Matter (SOM) and thereby increasing SOC in soils. Good SOC content leads to better soil fertility while bring higher and more resilient yields.

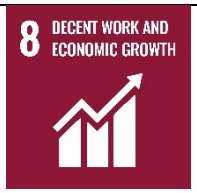
SDG Goal	Chosen Parameter	Project Impact
	drought, flooding and other disasters and that progressively improve land and soil quality.	
	3.9 By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination.	Stopping crop residue burning will reduce air pollution (presence of PM2.5 in air) in the region which will reduce respiratory related health issues.
	6.6 By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes	Increase in the SOM content improves the soil aggregate and structural stability, which helps to improve water retention and infiltration by increasing soil aeration and reduces excess runoff.
	8.6 By 2020, substantially reduce the proportion of youth not in employment, education or training	The project provides employment to local communities during the implementation and monitoring process
	13.3 Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning.	The project promotes sustainable land management practices in the project area, thereby removing atmospheric CO_2.
	**15.3** By 2030, combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world	The project promotes activities that improve soil fertility and combat land degradation. At present, soils in the region have degraded to a significant extent. Improved agriculture practices planned under this project will help to improve overall soil health throughout the region.

Table 1: Sustainable Developmental Goals identified for this project

A detailed monitoring plan for the above SDG parameters will be provided during the validation stage.

1.18 Additional Information Relevant to the Project

Left blank intentionally as per Section 3.1.3 of the VCS Procedural Document; Registration and Issuance Process: (Version 4.1)

2 SAFEGUARDS

2.1 No Net Harm

Left blank intentionally as per Section 3.1.3 of the VCS Procedural Document; Registration and Issuance Process: (Version 4.1)

2.2 Local Stakeholder Consultation

Left blank intentionally as per Section 3.1.3 of the VCS Procedural Document; Registration and Issuance Process: (Version 4.1)

2.3 Environmental Impact

Left blank intentionally as per Section 3.1.3 of the VCS Procedural Document; Registration and Issuance Process: (Version 4.1)

2.4 Public Comments

Left blank intentionally as per Section 3.1.3 of the VCS Procedural Document; Registration and Issuance Process: (Version 4.1)

2.5 AFOLU-Specific Safeguards

Left blank intentionally as per Section 3.1.3 of the VCS Procedural Document; Registration and Issuance Process: (Version 4.1)

3 APPLICATION OF METHODOLOGY

3.1 Title and Reference of Methodology

The details of the methodology and tools applied for the grouped project are given below:

Title	Improved Agricultural Land Management
Version	2.0 (under development[4])

Reference	Approved VCS Methodology VM0042
Version date	21 December 2021
Sectoral Scope	14
Tools Applied	AFOLU Non-Permanence Risk Tool to estimate buffer credits as per VCS standard requirement.

Table 2: Details of the methodology and tools applied

3.2 Applicability of Methodology

Grouped Project

All new activities must meet applicability conditions listed in the below Table 3 and be demonstrated with justification in the project document.

The following table provides details of how each project Instance is eligible under Section 4 of the VM0042 methodology:

Applicability Condition	Justification
Projects must introduce or implement one or more new changes to pre-existing agricultural management practices.	The present baseline scenario is the continuation of mainstream intensive agriculture that has degraded cropland soil over time. The project introduces new improved agricultural practices that improve Soil Organic Carbon levels while restoring and enhancing soil health.
Project activities must be implemented on land that is either cropland or grassland at the project start date and remains cropland or grassland throughout the project crediting period.	The project involves only croplands as per methodological applicability guidelines. There is no other type of land (grassland, forest etc.) that will be included under this project. Geographic Information System (GIS) analysis has been done and it has been verified that the croplands remained croplands over the past 10 years and will remain as croplands during the project lifetime.
The project area must not have been cleared of native ecosystems within the 10-year period prior to the project start date.	As discussed above, the croplands remained croplands over the past 10 years and will remain as croplands during the project lifetime.
The project activity is not expected to result in a sustained reduction of greater than 5% in	All project activities help farmers to maintain or increase their productivity. There is no evidence

Applicability Condition	Justification
productivity, as demonstrated by peer-reviewed and/or published studies on the activity in the region or a comparable region.	that regenerative activities impact productivity rates in a sustained manner by any considerable extent. However, yields depend on each farmer's baseline yield levels and the specific system employed. In most cases, sustainable agriculture can sustain yields and/or lead to reduced production costs. Some practices, such as adding organic amendments to crops instead of synthetic fertilizer, have been shown to directly increase crop yields[53]. For other practices, it has been observed that yields might be reduced by 5-10% in the early 2-3 years after adoption but will improve over time to reach or exceed previous levels. Literature on the key practices being implemented suggests that yields do not change in a sustained manner: **No-till:** Literature review shows that no-till yields have matched conventional yields in 10 years across most agro-climatic zones[54]. Stopping stubble burning is often implemented as a form of no-till agriculture because the primary intervention to avoid burning is to plant the next crop with the previous crop residue still present on the field (for example, by using a Happy Seeder). **Cover Crops:** A review of literature indicates that cover crops do not cause a sustained significant decrease in yield, and often result in yield improvements when coupled with certain crop rotations[55]. **Crop Rotations:** Literature from similar other subtropical regions presents the possibility of

[53] Burgess PJ, Harris J, Graves AR, Deeks LK (2019) Regenerative Agriculture: Identifying the Impact; Enabling the Potential. Report for SYSTEMIQ. 17 May 2019. Bedfordshire, UK: Cranfield University
[54] Pittelkow, C., Linquist, B., Lundy, M., Liang, X., van Groenigen, K., Lee, J., van Gestel, N., Six, J., Venterea, R. and van Kessel, C., 2015. When does no-till yield more? A global meta-analysis. *Field Crops Research*, 183, pp.156-168.
[55] Abdalla, M., Hastings, A., Cheng, K., Yue, Q., Chadwick, D., Espenberg, M., Truu, J., Rees, R. and Smith, P., 2019. A critical review of the impacts of cover crops on nitrogen leaching, net greenhouse gas balance and crop productivity. *Global Change Biology*, 25(8), pp.2530-2543.

Applicability Condition	Justification
	yield increases with the adoption of crop rotations[56]. **Manure/Compost Application:** Multi-decadal studies in similar environments suggest that manure application dramatically improves crop yields[57]. **Fertilizer use optimization:** It is well known that fertilizers are inefficiently used in this region and greater efficiency should not compromise yields[58]. **Drip Irrigation:** This is one of the most efficient irrigation methods, with high water use efficiency. This practice is suitable for lands where water is scarce. There are studies across different crops on drip irrigation practices, where it has improved the overall productivity of the crops[59,60]. Any time a new practice is considered for adoption by the farmers, literature analysis of effects of those practices on crop yield will be carried out beforehand.
The project activity cannot occur on a wetland. Note that this condition does not exclude crops subject to artificial flooding where it can be demonstrated that crop cultivation does not impact the hydrology of any nearby wetlands.	All activities will only be taken up on croplands, which are neither wetlands nor grasslands. This will be substantiated with maps and KML files.
The project activity cannot include application of biochar as a soil amendment.	This is not applicable for this project since none of the project activities promotes biochar as a soil amendment.

[56] Zhao, J., Yang, Y., Zhang, K., Jeong, J., Zeng, Z. and Zang, H., 2020. Does crop rotation yield more in China? A meta-analysis. *Field Crops Research*, 245, p.107659.
[57] Hua, W., Luo, P., An, N. *et al.* Manure application increased crop yields by promoting nitrogen use efficiency in the soils of 40-year soybean-maize rotation. *Sci Rep* **10,** 14882 (2020).
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Applicability Condition	Justification
Use of any model in estimating stock change/emissions	The project does not use a model to estimate stock change/emissions, so the stock change/emissions estimation model's applicability conditions are not required.

Table 3: Applicability Criteria

3.3 Project Boundary

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3.4 Baseline Scenario

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3.5 Additionality

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3.6 Methodology Deviations

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4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

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4.2 Project Emissions

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4.3 Leakage

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4.4 Net GHG Emission Reductions and Removals

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5 MONITORING

5.1 Data and Parameters Available at Validation

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5.2 Data and Parameters Monitored

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5.3 Monitoring Plan

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