REGEN
REGISTRY

Methodology Proposal for Soil Organic Carbon Estimation in Regenerative Cropping and Managed Grassland Ecosystems

V.0041 to v.0042

-Methodology Review-

Internal R2 Review Round

Gisel Booman

Ned Horning

[08/30/2022]

REGEN
REGISTRY

CONTENT referenced by reviewer's comment *e.g. Section number + paste exact text*	**REVIEWER'S COMMENT** *Please paste the comment from the reviewer*	**AUTHOR'S RESPONSE** *Please describe how the comment was addressed and include new content in quotations*	**Reviewer's Conclusion** [PASSED/ REJECTED *WITH COMMENTS*]
		*Title of methodology was updated	
1.1 "1. SOC stocks. 2. CO2 equivalents (CO2e)."	Wouldn't these be SOC stocks measured as CO2 equivalent?	Scope updated to "This methodology protocol proposes the use of remotely sensed multispectral imagery and soil sample results to train an Artificial Neural Network (ANN) to monitor changes in track estimate Soil Organic Carbon (SOC) stocks, within a project area, through time. The project area will be defined in the credit class document. The SOC change will be reported as CO2 equivalent. The main soil ecological health indicator, assessed in this methodology, will be carbon sequestration consisting of:"	*PASSED*
1.2 "monitoring the carbon levels"	better to say "by monitoring changes in....	No change	*PASSED*
1.3 "(ML)	If you are using ANNs then maybe use that instead of the more general ML	Addressed later in the document in 3.3	*PASSED*

2.2 “will adhere to the following. This proposal will initially be based on annual sampling”	It's not clear what "the following" is. Some clarity is needed. This is a methodology not a proposal. If you require annual sampling you can state that.	Changed to “The project timeframe will be defined as the period during which SOC stocks will be monitored. This methodology will initially be based on annual sampling rounds. The schema will be modified if an extreme climatic event or disaster is declared in or near the project area.”	*PASSED*
3.5.1 “The proposed CGS method”	So, CGS will be used for year 0 but what will be used for subsequent sampling years? Will you use permanent plots for future sampling? If not it would be good to know why not.	Changed to “Compact Geographic Stratification (CGS) will be the initial soil sampling scheme used to collect the Year 0 baseline soil samples. The main reason for choosing the CGS method was its suitability to areas where there is no previous knowledge of variability of SOC or a proven suitable proxy to provide accurate stratification (De Gruijter, Minasny and Mcbratney, 2015). Also, in laboratory experiments targeted at SOC and remote sensing data CGS was used by Bartholomeus et al., (2008). CGS makes the assumption that the sub-sample areas are smaller than the global variability (de Gruijter et al., 2016). Knowledge of the variability, gained during baseline, CGS sampling, will help optimize the number of samples in future sampling rounds and guide any change in the sampling methods in future sampling rounds.”	*PASSED*

3.5.2 1."Date"	Date doesn't vary spatially so not sure how this would be used. Perhaps season is important if you have models optimized for specific periods during the growing season.	Added "to allow for seasonal change."	*PASSED*
3.5.2 2. "ancillary data"	You need to define what you mean by ancillary data. Typically the ancillary data is adding additional predictor variables such as those noted in the list above. Below it seems as if you'r augmenting your sample data using date outside the project area which is different. You can do both but that should be more clearly stated.	Added in "Ancillary data may be used to augment the ANN training dataset by adding additional Predictors." to begin section and then changed to "The soil sample dates and the sample dates for the ancillary data will fall within one month of each other."	*PASSED*
3.5.2 2. "The ancillary"	maybe add "dynamic" since slope, aspect, soil type would not be expected to change over project period.	Added in "Ancillary data may be used to augment the ANN training dataset by adding additional Predictors." to begin section and then changed to "The soil sample dates and the sample dates for the ancillary data will fall within one month of each other."	*PASSED*

3.5.5 “area. Ancillary data dates will not have to fall within the +/- 4-”	This seems to contradict the first bullet point under ancillary data requirements	Deleted	*PASSED*
3.7 “accuracy”	accuracy or uncertainty?	Changed to uncertainty	*PASSED*
3.7 Equation comments	You need to specify where the soil sample values come from. That likely requires defining your train/test/validate data partitioning scheme.	Updated equations and text to read: “The network prediction uncertainty will be quantified using the mean absolute percentage error (MAPE), where number of values (n), soil sample value (At), network predicted value (Ft): The MAPE will be calculated by overlaying the original soil sample positions (At) on the raster map (Ft) generated by the ANN prediction process. A proportion of the soil samples will be those withheld from the training dataset for validation.”	*PASSED*
3.7.1 “network”	Maybe use "model" here?	Left as network	*PASSED*
4.4 “*may include*”	You seems to be missing model prediction uncertainty.	Added in 4th item: “ANN prediction uncertainty.”	*PASSED*
7. “made available”	The final prediction model should be made available so the verifier so they can replicate your results.	Replaced ML with ANN in this section and added in: “Final SOC stock estimates should be recreated and compared to sampled values, where available 5. ANN	*PASSED*

		• The trained network. • Training data.”	