Reviewer Report: Manuscript essd-2025-213
Title: The Global Spectra-Trait Initiative: A database of paired leaf spectroscopy and functional traits associated with leaf photosynthetic capacity
Major Strengths

High Scientific Value: Establishes the first open-access global database (GSTI) systematically integrating leaf spectroscopy and photosynthetic functional traits, addressing a critical data gap for cross-species/environment spectral model development.

Methodological Standardization: Provides unified data processing workflows (R scripts) and parameter-fitting standards (e.g., FvCB model), ensuring data comparability and reproducibility.

Exceptional Data Scale: Covers 41 sites, 397 species, and >7,500 observations—significantly exceeding existing similar efforts.

FAIR Compliance: Open data (GitHub/ESS-Dive) under CC-BY 4.0 aligns with modern scientific data-sharing practices.

Required Revisions: Scientific and Logical Issues
1. Contradiction in Methodological Description

Issue (Page 10):
Original text: "We considered the mesophyll conductance infinite, therefore estimates of V_{cmax25},J_{max25} and are 'apparent' values..."
Problem: The phrasing "considered" inaccurately implies an active choice, while the FvCB model inherently assumes infinite g_m .
Revision:

"The FvCB model intrinsically assumes infinite mesophyll conductance; thus, estimated parameters represent apparent values based on intercellular CO_2 concentration (C_i)."

2. Inadequate Discussion of Data Representation Bias

Issue (Pages 14–15, Fig. 5):

Data for temperate coniferous forests are minimal (32 observations, no full-range spectra), yet the text claims coverage of "temperate mixed broadleaf forests" without

highlighting this gap.

Africa is entirely unrepresented (e.g., savannas comprise ~11% of global vegetated area), potentially limiting model generalizability.
Revision: In Section 4.1 ("Data coverage"), quantify ecological significance of underrepresented biomes (e.g., African savannas, Mediterranean ecosystems) and assess impacts on model robustness.

3. Ambiguous Model Validation Protocol

Issue (Page 12):
PLSR validation uses "random selection of 80% for training and 20% for validation" but omits whether sampling was stratified by dataset. Global randomization risks data leakage if samples from the same dataset appear in both training/validation sets.
Revision: Clarify the sampling strategy (e.g., "stratified random sampling by source dataset") to prevent overestimation of model performance.

4. Missing Figure Citations

Issue (Page 16):
The description of trait correlations ("Figure 7 illustrates...") lacks a formal figure citation.
Revision: Insert "Figure 7" when first referenced:

"Figure 7 illustrates bivariate relationships between V_{cmax25} and other traits..."

Language and Presentation Errors

Inconsistent Terminology (Page 6 vs. Table 1):

Text uses "leaf mass per area (LMA)", but Table 1 abbreviates it as "ALM".
Correction: Standardize to "LMA" throughout.

Ambiguous Units (Table 1):

"Wave_XX: Reflectance at wavelength XX, percent"
Correction: Specify as "Reflectance (fraction, 0–1)" or "Reflectance (%, 0–100)".

Incorrect Subscript (Fig. 6 Caption):

"TPUs " → Correction: Use "TPU_{25} " (consistent with text).

Typographical Error (Abstract):

"agricultrual" → Correction: "agricultural".

Additional Recommendations

Data Quality Control: Expand Section 2.2.6 to describe outlier handling (e.g., exclusion criteria) when f.Check_data() flags values outside expected ranges.

Roadmap for C4/CAM Data: In Section 4.1, specify plans/timelines to incorporate C4/CAM species (e.g., collaborations in progress).

Citation Updates: Replace preprint citations (e.g., Luo et al., 2024) with peer-reviewed versions where available, or label as "in review/preprint".

Decision
This work presents a valuable contribution to plant spectroscopy and functional ecology. However, revisions are required to address methodological clarity, data representativeness, and presentation consistency.
Recommendation: Minor Revision

Sincerely,

Invited Reviewer, ESSD